Railway Engineering and Maintenance

September, 1931

RAILWAY ENGINEERING AND MAINTENANCE
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Alphabetical Index to Advertisers, Page 838 Classified Index to Advertisers, 834-836

IN ANSWER TO

Four Cylinders - FOUR SPEEDS - *Either Way*

SPECIFICATIONS

4-SPEED, HEAVY-DUTY TRANSMISSION
Big enough for 30 H.P.; has made good in 3 years' taxicab service, hardest steady grind.

PROPELLER SHAFT DRIVE
No friction surfaces exposed to grit.

ALL FOUR SPEEDS REVERSIBLE
Fairmont ball and roller bearing reverse gear in aluminum case on rear axle, gives car four speeds in either direction, quick.

GEAR DRIVE THROUGHOUT—NO SLIP
Like 95% of all trucks, the A3 uses all-gear and shaft drive. The Borg and Beck single plate dry disc clutch is built to handle 30 H.P.

SEAT—27½x76½"; room for 9 to 10 men.

WEIGHT—1,365 lbs. with rail skids (standard equipment) and 16" wheels (optional).

4-CYLINDER, BALL BEARING ENGINE
Bore 2¾", stroke 3½"; 7 to 15 H.P. at 900 to 2,000 R.P.M.
Very smooth-running due to high grade construction. Ball bearing crankshaft, camshaft, governor, and fan. Large radiator.

CONTROL COCKPIT—Safer because driven like auto, from comfortable position.

TRAYS—Two 18½x81"; end depth 4½", side 3½".

RUGGED STRUCTURAL STEEL FRAME
Six 3" 4.1 lb. channels, two torque angles, eight gusset plates, held by ½" cut thread bolts with malleable bevel and stout lock washers.

DEMOUNTABLE BODY—Deck, seat and safety railings lift off as one unit. Front end of seat swings up for access to spark plugs, fan, etc.

4-WHEEL BRAKE—Self-centering Raybestos-lined shoes, adjustable toggles, central lever.

RUNNING GEAR—Wheels 16x¼" Demountable; drive axle 1¾"; axle bearings Ringseald-Bower.

THE RAILROAD WORLD

Steers with the ease of a truck!

A feature that makes NORTHWEST worth more!

The Northwest patented crawler base brings supermobility to the user of crawler machines. The Northwest steers from the cab without lining the cab up with the crawler base. Positive traction is maintained on both crawlers while turning as well as while going straight ahead—100% power on both treads instead of 60% loss when power is needed most.

With this supermobility Northwests easily cross rails, travel from car to car, over platforms and ramps without delay in operation or destruction to flooring in much less time than is required with other types of crawlers.

It is one of the many reasons why over 40% of the crawler machines on railways are Northwests.

NORTHWEST ENGINEERING COMPANY
1713 Steger Bldg., 28 E. Jackson Blvd., Chicago, Ill., U.S.A.

NORTHWEST

The standard by which shovels and cranes are measured

Gravel has been spread over the track to the top of the rail. At a single setting, a raise of 8 inches is being made.

STRAIGHT UP!

The Nordberg Power Jack raises track straight up. There is no tendency to push or drag it out of line. The base or shoe of this jack is 6½″ wide and 50″ long, so broad and so long that it cannot possibly tip, slip or kick out like the ordinary track jack. Little if any realigning is necessary. There is no probability of tie beds being disturbed.

There are reasons why Nordberg Power Jacks produce track that "stays up" better and requires less future maintenance. In addition to doing a better job, it does it quicker and with less expense.

Let us tell you more about the Power Jack and the other machines that Nordberg has developed to aid in track maintenance work.

Railway Equipment Department

NORDBERG MFG. CO.

Milwaukee **Wisconsin**

NORDBERG

POWER JACK

Winter King Switch Heaters keep switches operating and reduce cost of snow removal

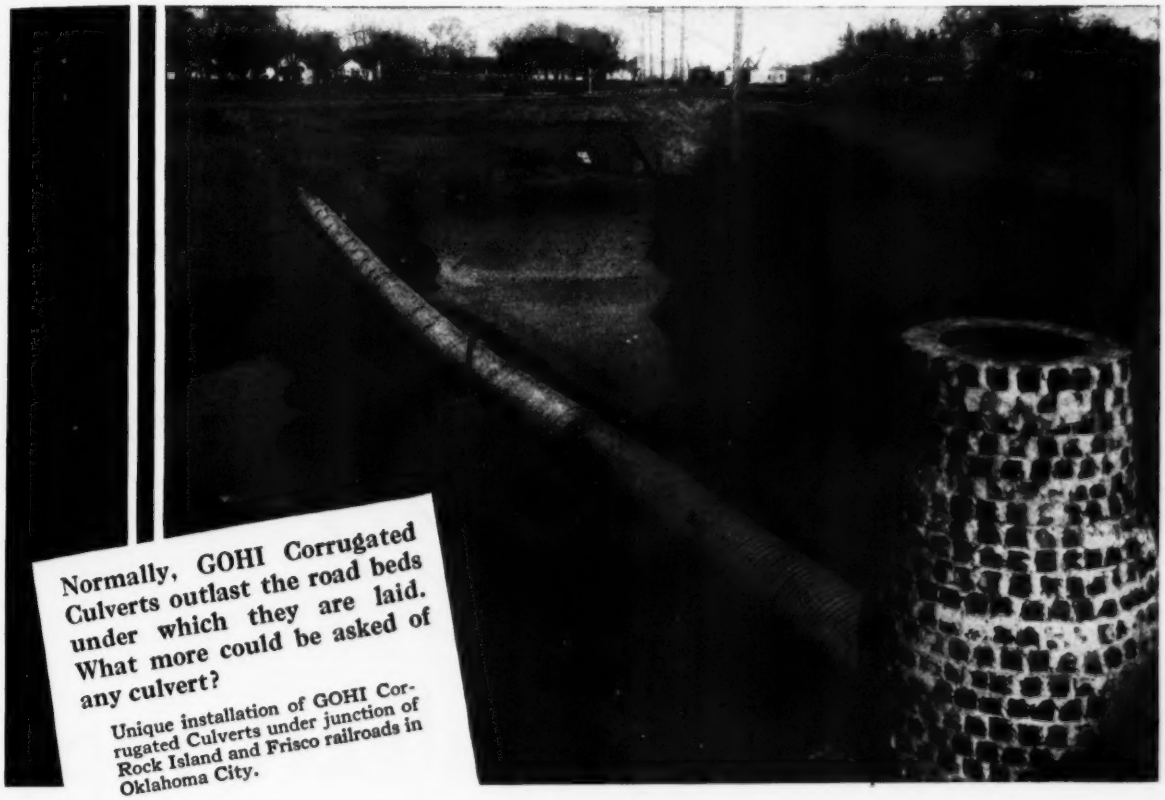
THE Winter King Switch Heater keeps switch points free of ice and snow and switches open through the worst conditions of winter weather. Where these heaters are installed, the cost of snow removal is about one-third of that with hand method. One man can take care of about one hundred heaters, thereby considerably reducing, or eliminating entirely extra labor.

The Winter King Switch Heater is made of copper-bearing steel. The standard-size heater is 18 in. long by 4½ in. wide by 5½ in. high, or a total height of 7½ in. to the top of the guard. The heater consists of a steel box with two compartments, a combustion chamber containing a mineral-wool wick and a fuel chamber of about 1¾ gal. capacity. A large wick opening permits the heat to flow around the switch point and the stock rail. This opening has two flanges that act as spacers to maintain the proper distance between the heater and the bottom of the switch point and to protect the ties. A sliding cover with thumb-screw attachment, permits regulation of the flame. In the top of the fuel chamber there is a small opening for filling. The Winter King Switch Heater has an oil capacity sufficient for about nine hours' operation.

BETHLEHEM STEEL COMPANY
General Offices: Bethlehem, Pa.

District Offices: New York, Boston, Philadelphia, Baltimore, Washington, Atlanta, Pittsburgh, Cleveland, Detroit, Cincinnati, Chicago, St. Louis.
Pacific Coast Distributor: Pacific Coast Steel Corporation, San Francisco, Portland, Los Angeles, Seattle, Honolulu.
Export Distributor: Bethlehem Steel Export Corporation, 25 Broadway, New York City.

BETHLEHEM



Normally, GOHI Corrugated Culverts outlast the road beds under which they are laid. What more could be asked of any culvert?

Unique installation of GOHI Corrugated Culverts under junction of Rock Island and Frisco railroads in Oklahoma City.

They Outlast the Road Beds

GOHI FABRICATORS

The Newport Culvert Co.
Newport, Ky.

The Pennsylvania Culvert Co.
Philadelphia, Pa.

Denver Steel & Iron Works Co.
Denver, Colo.

A. N. Eaton, Metal Products
Omaha, Nebr.

Feenaughty Machinery Co.
Portland, Oregon

Capital City Culvert Co.
Madison, Wis.

Roanoke Sales Corp.
Roanoke, Va.

Tennison Brothers
Texarkana, Ark.

Central Culvert Co.
Ottumwa, Iowa

Tennison Brothers
Oklahoma City, Okla.

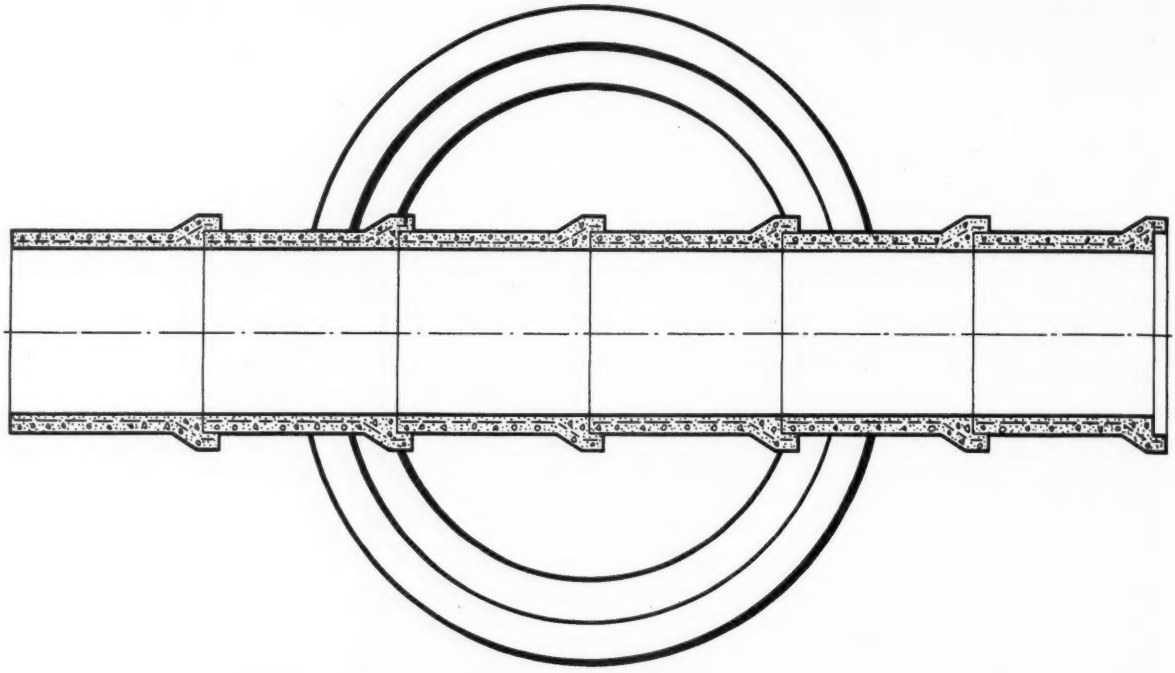
St. Paul Corrugating Co.
St. Paul, Minn.

GOHI Culverts meet copper-bearing pure iron requirements in all accepted specifications for corrugated metal culverts.

GOHI Culverts that have been in the ground for more than twenty years show little or no deterioration today. The reason is: The rust-resisting qualities of the base metal from which they are made. This metal is GOHI. Its guaranteed analysis is — 99.90% PURE IRON COPPER ALLOY. Write to any GOHI Fabricator for full details of GOHI Culvert low-cost railway drainage.

GOHI CULVERT MANUFACTURERS, Inc.
Newport, Kentucky

GOHI
PRONOUNCED "GO-HIGH"
Corrugated CULVERTS



Use Railway Culvert Pipe *designed especially for* Railway Conditions!

BELL AND SPIGOT JOINTS Deep socket balls insure tight joints and provide additional strength where most needed.

LONG LENGTHS Reduce handling and number of necessary joints to a minimum and aid materially in preserving grade and alignment.

OVAL SHAPE Affords greater water area than round pipe of equivalent size and facilitates inspection and clean outs.

THE COST of pipe is usually a minor part of the total cost of a culvert installation. Why not have the best pipe obtainable?

A quarter century of satisfactory service on America's leading railways has proven the advantages of Massey Oval Bell and Spigot culvert pipe.

Specify it in your requisitions.

MASSEY

CONCRETE PRODUCTS CORPORATION

People's Gas Building, Chicago, Illinois

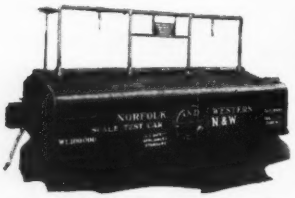
Sales Offices: New York, Atlanta, Cincinnati, St. Louis, Los Angeles, Minneapolis—310 Dominion Square Building, 1010 St. Catherine Street West, Montreal, Que.

RE&M 9 Grey

The Most Progressive Railroads *have adopted* SOUTHWARK SCALE TEST CARS

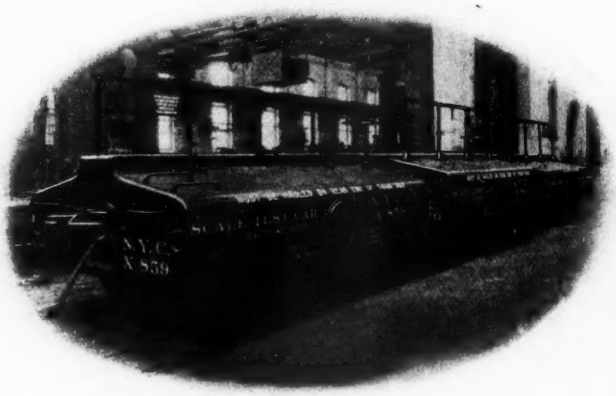
as standard equipment

Detroit, Toledo & Ironton R. R. Co. (Ford Transportation Co.)

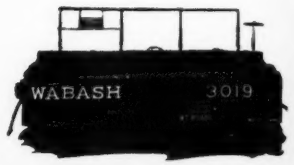


Norfolk & Western Ry. Co.

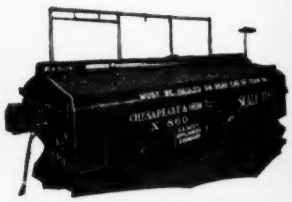
Morgan's Louisiana & Texas R. R. (Southern Pacific Lines).



Southwark Scale Test Cars are designed to comply with requirements of test cars in use by the Bureau of Standards, Department of Commerce, but also embody many improvements such as one-piece body, air brakes, spring equalization, etc.



Wabash Ry. Co.



Chesapeake & Ohio Ry. Co.

Illinois Central R. R. Co.

Some of the Railroads Using Southwark Test Cars

		Capacity, Pounds
Illinois Central R. R. Co.	1	80,000
Norfolk & Western R. R. Co.	2	100,000
Southern Pacific R. R. Co.	1	80,000
Chesapeake & Ohio R. R. Co.	2	80,000
Southern Pacific Lines	1	80,000
Wabash Railway Co.	1	80,000
Kansas City Southern Ry. Co.	1	80,000
Detroit T. & I. R. R.	1	80,000
Illinois Central R. R. Co.	1	80,000
New York Central Lines	1	50,000
New York Central Lines	1	100,000
Atlantic Coast Line R. R. Co.	1	80,000
Reading Co.	1	100,000
Chicago & Northwestern Ry. Co.	1	80,000

		Capacity, Pounds
Barney Machinery Co., Inc.	1	80,000
Union Pacific	1	80,000
M. K. & T. Railroad	1	80,000
Northern Pacific	1	80,000
Tennessee Coal & Iron Co.	1	100,000
Tennessee Coal & Iron Co.	1	50,000
New York Central R. R.	2	80,000
Southern Ry. Co.	3	80,000
Southern Pacific Co.	1	80,000
E. Ferro Central de Brazil	1	88,000 (40 Metric Tons)
Missouri Pacific R. R.	1	80,000
Great Northern Ry.	2	80,000
New York Central Ry.	6	80,000
Hocking Valley Ry.	1	80,000

BALDWIN SOUTHWARK CORPORATION-SOUTHWARK FOUNDRY & MACHINE CO. DIV.

SOUTHWARK
PHILADELPHIA

No. 33 of a series

Railway
Engineering and Maintenance
SIMMONS-BOARDMAN PUBLISHING COMPANY

105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: Our Canadian Readers

August 27, 1931

Dear Reader:

In publishing Railway Engineering and Maintenance we have always considered our readers in the United States and in Canada as one group. The International boundary has been of no concern to us or to you who look to us for new ideas in railway maintenance and improvement work from month to month. In standards of construction and methods of work the problems are the same. In selecting material for publication we have, therefore, given no thought as to whether ideas originate on the Canadian Pacific or the Southern Pacific. Likewise, we have never made any distinction in the subscription cost of the paper.

Effective with this issue, however, we are confronted with a new problem for on September 1, a duty will be imposed on all business papers entering Canada. For Railway Engineering and Maintenance this amounts to 60 cents per year. While we have no right or inclination to question such action on the part of a neighboring nation we regret it for it imposes an added burden on us in our attempt to serve those of you who are located in Canada. It is a burden, furthermore, which we must ask you to share with us, for as you already know, the income from subscriptions to a publication like Railway Engineering and Maintenance represents only a fraction of the cost of delivering the publication to you.

To meet this increased cost we must, therefore, increase our subscription price for delivery in Canada from $2.00 per year to $2.50 and for two years from $3.00 to $4.00, increases which, as you will note, are less than the amount of the duty. We have arranged, furthermore, to absorb the tax for all subscriptions now in effect, regardless of the date of their expiration. In fact we are going still further in our attempt to modify the effect of this tax on you, for we will accept at the old rate and absorb all of the tax for one year additional on all renewals expiring up to December 31, 1931, providing these renewals are received promptly. By these measures we are endeavoring to convince those of you who live in Canada of our interest in you.

We are proud of our subscribers who reside in Canada. We trust that the relationship which has existed between us for so many years will continue. The measures which we have outlined above are an indication of our desire in this regard.

Yours very truly,

Elmer T. Howson

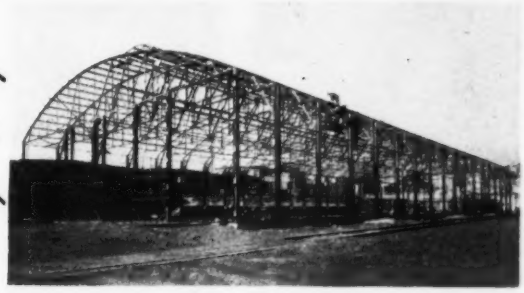
ETH*MM

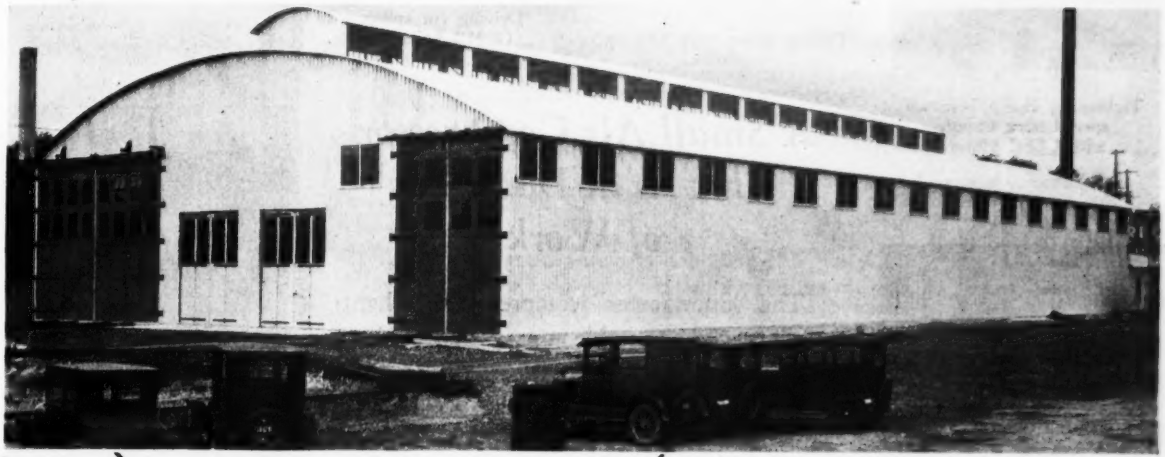
Editor.

MEMBERS: AUDIT BUREAU OF CIRCULATIONS AND ASSOCIATED BUSINESS PAPERS, INC.

MADE ENTIRELY OF STEEL

BUTLER

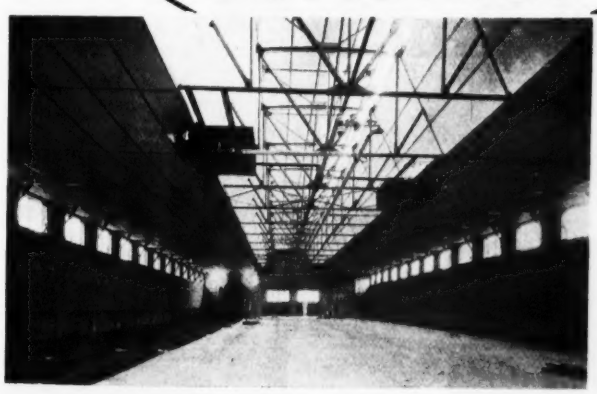




READY-MADE

STEEL

BUILDINGS



At the top right is a photograph of the structural steel frame which carries the C. B. & Q. Fruit House. Its members are designed to give the greatest strength per pound of steel and fabricated in units such as to facilitate quick assembly. The large photograph shows the finished building with the panel corrugated wall and roof sections bolted into a finished exterior. The special Butler panel corrugation multiplies sheet steel strength fourfold over ordinary corrugating. The interior view above the inside insulation is accomplished with Nu-wood a commercial wall board. Insulation and heating facilities are such as to maintain a 50 degree temperature in coldest weather.

C. B. & Q. FRUIT HOUSE

MINNEAPOLIS

Perishable cargoes such as fruit necessitate special railway handling facilities in the north country where the weather really gets cold.

The Chicago, Burlington and Quincy Railway has economically solved the problem of unloading and handling car load fruit at Minneapolis with the large Butler Ready-made steel building pictured here.

With a span of 90 feet, a height of 22 feet and a length of 200 feet, it shelters four freight car tracks—two on each side of a double drive truck loading platform. Track doors are 21 feet high, one of them 16 feet, the other 29 feet wide. Two 12 x 14 foot truck doors are in each end giving a double truck drive through the building.

The monitor atop the round steel roof is 16 feet wide, 5 feet high and 156 feet long. 105 stationary and 66 large ventilating type steel window sash, each with 9 lights, daylight the interior. Attached to the rear of the main building is a 24 x 24 foot boiler house sheltering the heating equipment. Approximately 150 tons of steel were utilized in the manufacture of this mammoth fruit house. By way of contrast a small scale house is pictured below at the left. The adaptability of Butler Ready-made, standardized unit design has a full range between these two extremes in railway structures. Butler engineering service will supply you with full details and prices on any size and type of building now under consideration, be they scale houses, track car houses, material depots, freight depots, car repair shops, material treating plants, machine shops, truck and bus garages, signalmen shelters, transformer houses, power houses, et cetera. Railway construction and railway maintenance departments both Save With Steel in Butler Ready-made, standardized unit design structures. We shall be glad to demonstrate with our proposals.

BUTLER MANUFACTURING COMPANY

1247 Eastern Ave. KANSAS CITY, MO.

MINNEAPOLIS, MINN. 947 Sixth Ave., S. E.

Send complete information on Butler Ready-made Steel Buildings, particularly a building approximately .....ft. by..... ft., to be used for .....

Firm Name.....

Address .....

Tightening clamp bolts on special track fittings with CCSC Motor.

Pulling spikes with SP9 Spike Puller.

Driving cut spikes with CC250 Spike Driver.

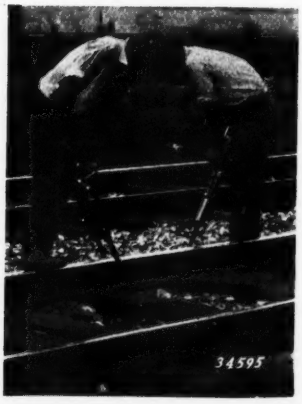
Boring spike holes in tie with CCW Wood Borer.

Grinding rail joints with Size 4 "Multi-Vane" Grinder.

Rail drilling with 90 Rail Drill.

Bolting-up rail joint with 99C Wrench.

The SPOTTAMPER Compressor



"Smoothing-up" track with pneumatic tampers

Published on the last Thursday preceding the month of issue by the

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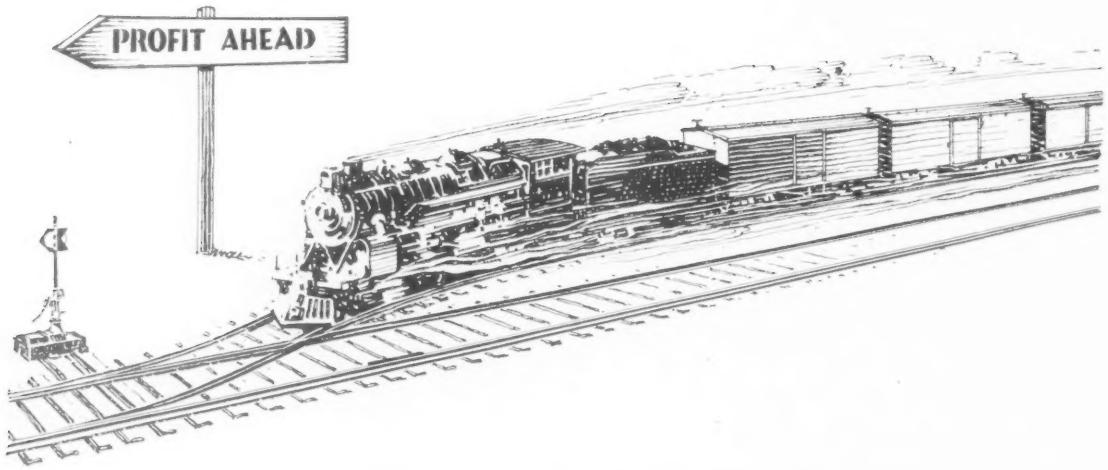
Railway Engineering and Maintenance

NAME REGISTERED U. S. PATENT OFFICE

SEPTEMBER, 1931

NO TRAIN STOP... SWITCH TO PROFIT



The Racor 3-in-1 Switch Stand (style No. 100-A) is especially designed for use at the ends of double track and passing sidings. It maintains a right of way in both directions . . . eliminates train stops for switching operations. When installed at locations of average traffic the 3-in-1 makes possible an annual saving of $18,250.

Be on "Velvet" in a Month

The average cost of stopping and starting a fifty-car train travelling at thirty miles an hour is $2.50. When a rigid stand is used at the ends of double track, a train must stop and start twice for switch operations. With the 3-in-1 there is "No Train Stop" and you "Switch to Profit". It saves its installation costs within the first month . . . then you are on "Velvet".

Three Features in One

This Stand combines three simple mechanisms in one compact housing. They are:

1. A rigid-throw for hand operation.
2. Two double-coil springs returning points after trailing train has passed.
3. An oil-buffer retarding the return of the points between successive pairs of wheels.

Severe tests by many leading railroads have caused them to adopt this Stand as standard. None of our claims has been disproved . . . They showed conclusively that the Stand could not be locked with an object intervening between a point and stock-rail. The 3-in-1 has earned a large and immediate profit at all locations it has been used . . . It has speeded train movements. We want the privilege of supplying your road with these Stands. Write for complete printed information. Your request will receive instant response.

RAMAPO AJAX CORPORATION

Racor Pacific Frog and Switch Company . . . . . Los Angeles—Seattle
Canadian Ramapo Iron Works, Limited . . . . . Niagara Falls, Ontario

General Offices—230 Park Avenue, New York

Sales Offices at Works and McCormick Bldg., Chicago Midland Bank Bldg., Cleveland, Ohio Builders Exchange Bldg., St. Paul Metropolitan Bank Building, Washington Union National Bank Building, Houston, Texas

Nine Racor Works: Hillburn, N. Y. Niagara Falls, N. Y. Chicago, Ill. East St. Louis, Ill. Superior, Wis. Pueblo, Col. Los Angeles, Cal. Seattle, Wash. Niagara Falls, Ont.

RACOR

Railway Engineering and Maintenance

COMPETITION

Government Subsidies Give Unfair Advantage

TO EVERY railway employee, the critical situation now confronting the railroads is of very direct concern. Many have been laid off; not a few have had their salaries or wages reduced; and others are working part time. Yet with all these measures and with many drastic cuts and, in not a few instances, the complete elimination of returns to stockholders, the net return of many of the roads is still so small as to jeopardize the continued approval of their securities as legal investments for banks and trust funds. The effect of this situation is so far reaching that it becomes the concern of every railway employee to so fully inform himself regarding the causes contributing to this situation that he can, in turn, acquaint those with whom he comes in contact with the facts.

Government Aids Competitors

Not the least important influence that is contributing adversely to the welfare of the railways is the support that is being given by the government to competing agencies of transportation—a policy that is gaining momentum and is becoming increasingly menacing to the railways. Take the Panama Canal as an illustration. Built by the government of the United States with public funds, it opened a new route for the movement of traffic between the eastern and western seaboards, which has been utilized for the transportation of vast tonnages of freight that formerly moved by rail over the transcontinental lines. Faced with the loss of this traffic to the competing route made possible by government aid, the railways have long endeavored to put into operation rates between these coast points sufficiently low to retain for themselves a large part of this traffic. They have, however, been met at every step by the refusal of the Interstate Commerce Commission—another agency of the government—to permit such reductions unless they at the same time reduce the rates to interior points proportionately. This stipulation would result in such a drastic reconstruction of the entire rate structure and in such a drastic reduction in the income of the roads, that they cannot accept it and long remain solvent. As a result they have been forced by one agency of the government to allow much needed traffic to be diverted to another route, made possible by still another agency of the government—and built at public expense.

Still more unfair is the present movement for the extension of our inland waterway system with the channels built and maintained at the expense of the taxpayer. The government has itself engaged in transportation by the operation of a barge line on the Mississippi and Warrior rivers in direct competition with the railways at rates which do not even pay the direct cost of operation alone, even though no taxes are levied, while the right of way and, in a large measure, the terminals as well, are provided without charge, and the salaries of some of its executive officers are charged to still other accounts. Hence the public, through taxation, pays not only the deficits incurred in the operation of the government barge lines, but likewise the cost of channel and terminal maintenance, etc., in order that the traffic of a few favorably located shippers may be moved at a cost below that of rail transportation.

As if this were not enough, waterway advocates, at a meeting of the Upper Mississippi River division of the Mississippi Valley Association, announced on June 19, "that the business men of the Upper Mississippi Valley were in favor of a $500,000,000 bond issue by the federal government for the purpose of completing our national waterway program within a period of five years." Of special significance in this connection is a statement by C. C. Webber of Minneapolis, president of the Upper Mississippi Barge Line Company, that "to increase taxes at this time would unduly burden business, industry and the people generally. Therefore, we propose that Congress shall, at its next session, adopt the plan used by Roosevelt in financing the construction of the Panama Canal, and authorize the issuance of at least $500,000,000 worth of bonds." What Mr. Webber did not add was that users of the Panama Canal pay tolls for passage through it and the expenses are thereby borne at least in part by those who benefit from it, whereas, on the inland waterways, no such charges have been advocated and the cost will again be paid by the taxpayer. Approval of a bond issue, such as that suggested, would again place the government in the position of making large expenditures, from public funds, for the benefit of a few shippers in a limited area, and increasing the competition with existing railways which receive no such subsidy and which would thereby be required to increase the cost of handling the products of other shippers if they are to remain solvent.

Equally menacing and unfair are the public contributions which are made in such large sums for highway construction today, to provide rights of way over which

buses and trucks may operate in largely unregulated competition with the railways. These highways, built at public expense, are at once available for use by such common carrier buses and trucks, enabling them thereby to compete actively with the railways for both passenger and freight business. The railways must not only provide their rights of way, tracks and structures, but must also maintain them and make good the wear and tear—all out of earnings. The highway vehicle, on the other hand, makes no investment in roadway and pays a grossly inadequate sum for its upkeep. In support of this statement one need only call attention to the fact that in 1929, $1,646,030,433 was expended on rural roads, of which less than 42 per cent was met by special motor vehicle and gasoline taxes, leaving a burden of $958,300,081 to be paid by the general taxpayer. Here again the public is contributing to the support of an agency that is competing with and taking traffic away from the railways and thereby depriving railway employees unfairly of their source of livelihood.

Basis of Complaint

No one can complain rightfully of competition, providing it is on a comparable and equitable basis. It is only when the competitor is given an unfair advantage that there is ground for criticism. The railways are not contending for the elimination of competition by water and highway, but are only demanding that the agencies using these facilities pay a proper proportion of the costs of the right of way and terminal facilities provided for them and that they be subjected to comparable regulation as to character and reliability of service, stability of rates, etc. If and when such measures are taken and the railways are then unable to retain their traffic, they have no recourse. Until competition is placed on such a basis, they and their employees, are subjected to unjust discrimination to their detriment.

With a government organized as ours is, and with representatives chosen to act for the best interests of their constituents, it behooves railway employees to work individually and collectively for the education of the public at large, in order that they may select those representatives who have a fair appreciation of the position in which the railways and those that depend upon them for their livelihood, have been placed.

ROADMASTER'S NUMBER

October Issue Will Deal Especially With This Officer

THE roadmaster has long been a unique figure in railway service. In many respects he typifies the transportation industry. Rising from the ranks, he knows no hours, responding to any call, day or night, in order that trains may move safely and without delay.

Aside from those characteristics of faithfulness and dependability that have long been so outstanding, the roadmaster of today must be an executive of no mean caliber. Not only must he be able to get work done expeditiously, but it must be done economically as well. He must be a student of figures, constantly striving to so improve his methods as to lower his costs. He is also meeting more exacting demands in track maintenance by reason of the heavier trains and higher speeds. All in all, the roadmaster is one of the key men in railway service around whom present day transportation is being built.

Collectively the roadmaster has been as progressive as he has been as an individual. At a time when few other railway men realized the value of co-operative effort, the Roadmasters and Maintenance of Way Association was formed in 1882. It antedated the Bridge and Building Association by 8 years and the American Railway Engineering Association by 18 years. Until 1900 it was the only association dealing with the problems of track construction and maintenance. This year, for the first time in the 49 years of its existence, it will hold no convention. This action was taken only after the most careful consideration and in response to a request from the railway executives that the members devote every ounce of their energy to the solution of the present critical problems on the individual properties.

Since there will be no convention, and a corresponding absence of emphasis on the work of the Roadmasters' Association in our October issue, that has caused it to be termed the Roadmasters' Convention Issue for the last 15 years, opportunity is afforded us this year to direct attention to the roadmaster as an individual and to the part that he is playing and can play in the work of the railways. The next issue will, therefore, be designated the "Roadmaster's Number." In it will be presented a large amount of information of special interest to this officer and to those concerned with his work. We are sure that you will find it of interest.

SAVING BY SOFTENING

Water Treatment Now a Problem of Economics

IT IS not so many years since the treatment of water by any means came under the classification of extraordinary measures. Certain waters were softened only because their use in the raw state caused unending troubles. Serious interference with the regular movement of traffic by reason of engine failures and high locomotive maintenance charges due to frequent flue renewal and heavy boiler repairs were an essential background for any program for water conditioning. And even when the need for improvement was obvious, there was a reluctance to undertake anything but halfway measures. A plan for dumping soda ash in the engine tenders as water was taken was usually received with much more favor than the proposal to build a water softening plant or to adopt the use of a carefully formulated boiler compound that was to be administered under specific rules.

It was not until rather extended experience with treated water had permitted the definite evaluation of the benefit of water treatment that the conditioning of locomotive boiler waters came to be considered as a measure offering specific operating economies rather than something which had to be done to keep trains running. This change in the attitude of management has altered the entire aspect of water conditioning and it can now

be approached as a problem in practical economics, whether it concerns the treatment of water previously used raw or the proposal to introduce an improvement in the process of dealing with water already subject to some processing.

On the one hand, it is rather thoroughly established that the removal of a pound of encrusting solids results in a saving of 13 cents in fuel economy and reduced locomotive maintenance. On the other hand it is possible to determine within close limits what it costs to effect the removal of a pound of encrustants from a given water. In the case of boiler compounds, the expense is measured primarily by the cost of the compound used. In the case of roadside treatment, it is necessary to take into account the capital, depreciation and maintenance charges on the plant, cost of chemicals and the cost of operating the plant. In either case, it is necessary, of course, to know how much water is being treated since only in that way is it possible to determine how much encrusting material is being removed.

It should be readily apparent from a consideration of these elements that enter into the economics of softening water that the opportunities for further development in this field are by no means limited to the treatment of waters now used in their raw state. Thanks to improvements in water treating methods and in plant facilities, and because of the introduction of new processes, it is possible to institute two classes of refinements: (1) treatment of the water to a smaller residual hardness, thus removing a greater quantity of encrustants, and (2) reductions in the cost of treatment.

These two fields offer such a variety of possibilities that it is not feasible to discuss them here in detail. It suffices to say that the resourceful railway officer should have no trouble in finding many opportunities for the proposal of improvements that will produce large immediate economies. It remains for him to prepare his studies carefully and be able to demonstrate the justifiability of the projects which he advocates.

FIRE HAZARD

What of the Experience With Creosoted Wood?

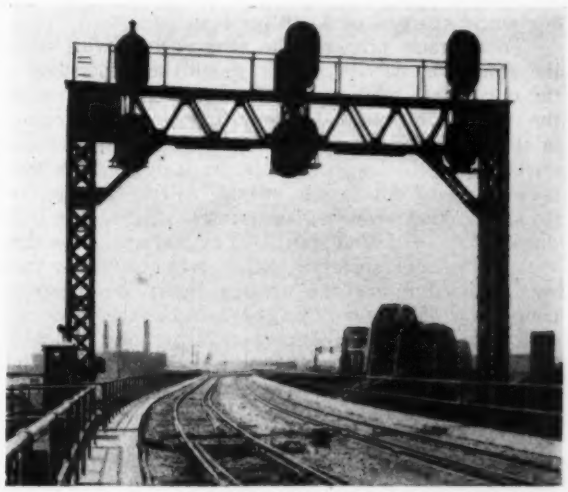
MUCH has been written and more has been said about the relative fire hazard of creosoted and untreated timber as well as of structures built of them. Furthermore, there is available a sufficiently complete record of enough fires to form the basis for certain rather well defined conclusions.

There appears to be general agreement that creosoted wood that has been exposed to the weather a sufficient time after treatment to cause the surface to be entirely devoid of free creosote, ignites no more readily than new untreated wood and probably less readily than old checked and punky wood. On the other hand, freshly creosoted timbers or wood from which the oil still exudes is easily ignited and if a fire is once started it spreads quickly. It is likewise agreed that if creosoted wood once ignites it is much harder to extinguish or control the fire than in untreated wood, although the circumstances attending any bridge fire are such that it usually burns itself out rather than being put out.

Furthermore, a fire in creosoted wood usually dies out without completely destroying the timber. Large sticks will be found to be thoroughly sound inside the charred exterior. The explanation offered is that the accumulating of a crusty ash produced by the burning creosote eventually provides a coating that excludes the oxygen. Under some circumstances, however, creosoted wood is entirely or almost entirely consumed in a fire. Regardless of whether this occurs or not a fire in the deck of a steel bridge is frequently the cause of serious damage to the steel.

In spite of the fairly general acceptance of the above facts, fires still occur. Such a one is described on page 795. That this fire occurred on a railway that has given so much attention to the technic of timber treatment and whose treating practices have long been recognized as being of such a high order, affords added cause for concern. That the wood-preserving industry is aware of the problem is shown by the fact that it has, for two years, had a committee investigating ways of making wood fire-resistant. The Harpers Ferry fire, however, emphasizes the necessity for all possible activity in the prosecution of this study of this subject in order to forestall other and possibly more serious fires.

In spite of unfortunate experiences, like the one at Harpers Ferry, with fires in structures built all or in part of creosoted wood, the benefits of treatment are so thoroughly established that the question of fire hazard has rarely been responsible for a decision to refrain from the use of wood so treated. Nevertheless it is important that all reasonable precautions be taken to prevent a conflagration, both by guarding against exposure of the wood to sources of fire and by measures to avoid the presence of free oil on its surface. The first requirement calls for scrupulous policing of the timber, while in storage and after placement in the structure; while the second demands that the wood be given ample opportunity to "season" before it is applied. During hot weather it may be advisable to cover horizontal surfaces with sand or portland cement so that any oil which exudes from the wood will be quickly absorbed. Constant watchman service while work is in progress and facilities for fighting a fire immediately after it starts or is discovered are also advisable.



Color Light Signals in Terminal Territory

Machines Speed Rail Laying on

Fully equipped and organized force, that averages 156 men, strips track and lays 5,237 tons of new steel in 12 days at an average cost of $1.77 a ton including the charges for the use of the equipment

Above — The Three Nordberg Spike Pullers With Nine Men Kept Well Ahead of the Rail-Laying Crew.

Right—Knocking off the Old Tie Plates and Preparing to Adze.

MANY roads, in recent years, have adopted mechanical aids in their rail laying work and have made highly creditable records in effecting rail renewals, but it is doubtful if any road has utilized power equipment more completely in its rail work and has secured more favorable results in this class of work than the Boston & Maine. Evidence in support of this is found in the work which has been done on the Fitchburg division of this road this year, where a gang averaging 156 men, with power spike pullers, power adzers, a crane, pneumatic nut runners, pneumatic spike drivers, power bonding and rail drills, and both cutting and welding torches, laid as many as 734, 39-ft. rails of 130-lb. section in 9½ hours of actual working time and 2 hours travel time, at a total cost, including equipment charges, of $1.58 per ton.

To appraise properly the effectiveness with which the work was carried out, it should be understood at the outset that while the above figure does not include the cost of distribution of the rail and track fastenings, or the picking up of the old rail and fastenings, it does include the full stripping of the track of its worn track material, with out-of-face adzing, full tie plating, rail laying, spiking, bolting, anchoring, bonding, and the dismantling of the old rail. All of the work was done without the interference of traffic, as full use of the track was obtained during the working hours, but upon the completion of the work in the evening, the track was restored to service without speed restrictions, and without the necessity for further work operations other than the picking up of the old track materials.

The rail laying work described in this article was done on the double-track main line between North Adams, Mass. and Johnsonville, N. Y., where the old track structure consisted of 100-lb. New Haven section rail with ordinary angle-bar joints and single-shoulder flat top tie plates. In the relay work, 130-lb. R.E. rail was laid on Lundie 8 in. by 12 in., double-shoulder tie plates, with a 1 in 20 cant and weighing approximately 19 lb. each. New Neafie joint bars and base plates were applied at the joints and nine anti-creepers were applied to each rail, Fair and Stead anti-creepers being used. The track on which the work was done is ballasted with washed gravel and trap rock.

Organization for Rail Laying

In the actual rail laying work a highly organized force averaging 133 men, including foremen was employed, and the work from the cutting of the joints at intervals, to the bonding of the new rails, was spread over about a mile, with each individual group in the organization working independently of the other groups and uninterfered with by them. While the organization varied somewhat in makeup on different days, and especially during the starting and closing-up work each day, a good picture of the general organization employed while operations were in full swing each day is given in the following:

Cutting joints and pulling spikes—1 foreman, 1 welder and 11 men—(3 power spike pullers).

Throwing out rail and preparing to adze—1 foreman, 1 assistant foreman and 16 men.

Boston & Maine

Adzing—1 foreman and 7 men—(3 power adzers).
Installing tie plates—1 assistant foreman and 7 men.
Laying rail—1 foreman, 1 operator, 1 welder and 7 men—(gasoline operated crane and one acetylene cutting outfit).
Assembling joints—1 assistant foreman, 1 operator and 12 men—(one 8-tool tie tamper compressor, 2 pneumatic nut runners).
Gaging and spiking—3 foremen, 1 operator and 38 men—(one 12-tool tie tamper compressor and 6 pneumatic spike drivers).
Applying rail anchors—1 assistant foreman and 2 men.
Signal bonding, when stranded plug bonds were used—1 signal foreman, 2 signalmen and 5 helpers—(3 power bonding drills).
Bonding, when welded bonds were used—4 welders, 2 welder helpers, 1 signalman and 1 signal helper—(4 acetylene welding outfits).
Dismantling old rail—1 assistant foreman, 1 operator, 1 welder, 1 welder helper and 7 men—(One 4-tool tie tamper compressor, 2 nut runners and an acetylene cutting outfit).

Total men actually engaged in rail laying	133
Miscellaneous—Including 4 cooks, 4 cook helpers, 1 watchman, 2 waterboys, 2 equipment maintainers, 1 cost man, 7 timekeepers and material checkers—total	21
Total men in rail laying force	154
Men picking up old rail, including foremen	19
Total men on entire job	173

The organization outlined above makes no provision for the renewal of turnouts, as all turnouts in the territory covered by the rail laying program were relaid in advance. Twenty-six turnouts were so laid on the Fitchburg division prior to the out-of-face rail renewal. Laying through road crossings, however, was included in the general rail renewal work, and such additional work as was necessary at these points was done by the rail laying forces, reorganized temporarily in-so-far as this was necessary.

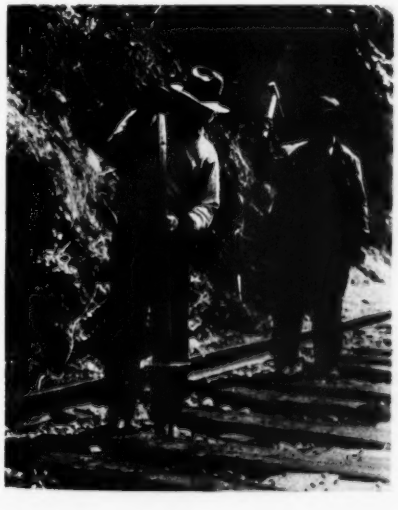
The first operation in the work, that of the breaking of the joints, was done to facilitate the lining out of the old rail. Ordinarily, breaks were made at every twentieth joint on tangent track and at every tenth joint on curves.

Pulling of the old spikes, which was the next major operation, was done with three Nordberg spike pulling machines, these machines operating together within a range of about 100 ft. Each machine was manned by three men and pulled spikes continuously for every third rail, both sides, before moving ahead and resuming operation. In addition to the nine men controlling the machines, two men with claw bars accompanied the gang and pulled such spikes as could not be gripped readily by the machines, particularly certain of the spikes at the rail joints.

The throwing out of the rail was done by six men with lining bars, the rail being thrown beyond the ends of the ties. Immediately following this gang came the group of ten men removing the old tie plates and placing tie plugs. In this latter group, two men removed tie plates, four placed and two drove the tie plugs, one man with a spike maul, assisted by the foreman with a punch mounted on a handle, drove all spikes without heads so that they would not interfere with the adzing, and one man with a rake leveled the ballast between the ties where necessary to clear the way for the adzing machines. All of the tie plugs used were treated, and were driven by simple tamping tools which permitted the men to stand in an upright position while working. This tool consisted essentially of a round flat steel plate, about eight inches in diameter, welded to a vertical pipe handle. The action secured with the tool was merely a direct downward blow on top of the tie plugs.

Power Adzers Used

All of the adzing was done with three Nordberg power adzing machines, each of which was operated by one man. These machines operated progressively over the ties, the first machine making the initial cut, the second machine making another cut, and the third machine making the finished tie plate seat. In this manner the three machines were kept relatively close together. The other four men included in the adzing gang were employed in changing the heads of the adzing machines, carrying the heads from a gondola supply car to the adzers, sharpening the cutting knives and in assembling



Above—Driving Tie Plugs With an Improvised Yet Effective Driving Tool. Right—Setting in the New Rail With a Burro Crane. Note Material Car Being Pulled Along by the Crane.

Left—Running up Nuts With an Air Compressor and Pneumatic Nut Runner.

Below—Starting Spikes in Advance of the Pneumatic Spike Drivers.

the heads. The two latter operations were performed in one end of a gondola car, pulled along with the rail laying operation by the crane setting in the rails. As a safety precaution, all men employed around the adzing machines were required to wear goggles and shin guards.

The tie plating gang included two men who, with brushes, painted the adzed portion of each tie with creosote, and five men who placed the new plates. In addition to placing plates, one man aided the assistant foreman in charge of this operation in measuring for the location of joint plates when it was necessary to install a short rail, as on curves. The creosote used was relatively thin and was applied cold. The supply of creosote was carried along with the rail laying operation in the gondola car previously mentioned.

Rails Handled by Burro Crane

The actual setting in of the rails was done with a Burro crane, and the 10 men employed in this operation included the foreman; one crane operator; three men, one at the rail tongs and one at each end of the rail, guiding it into position; four men, two at each end of the rail, gaging and spiking the rail sufficiently to allow the Burro crane to pass; and one man holding the expansion shims. One of the three men employed in actually setting the rails in place was a welder who, with an Oxweld cutting outfit, made the necessary rail cuts. The work of this gang was facilitated by the fact that the centers of the new rails had been marked during unloading operations, so that the rails could be picked up in balance without making several adjustments of the rail tongs.

The Burro crane pulled behind it a standard gondola car, which was used not only for the storage of the creosote used in painting the new tie plate seats and as a workshop for the grinding of the adzing machine knives, but also for the movable storage of a large number of track tools and supplies such as tie plugs and oxy-acetylene tanks. The car also carried the oxy-acetylene equipment used by the rail placing crew.

The gang applying the joint bars, which followed immediately behind the Burro crane, was equipped with an eight-tool Ingersoll-Rand tie tamper compressor, which operated two pneumatic nut runners and also furnished air for a pneumatic track drill used in re-drilling the rails where cuts had been made. In the group of 14 men which made up this gang, the assistant foreman and six men were employed in assembling the joints on the rail and starting the nuts, while the compressor operator and six men were employed in the operation of the nut-runners to tighten the nuts.

In carrying out this phase of the work, four or five joints were always being worked on at the same time, sufficient hose being used to permit the operation of the nut-runners on two different joints at the same time. One spare nut runner was always kept with this gang so that it would not be delayed in case of an emergency.

The gaging and spiking force of 42 men, which was equipped with five to eight track gages, a 12-tool Ingersoll-Rand compressor and six I-R pneumatic spike

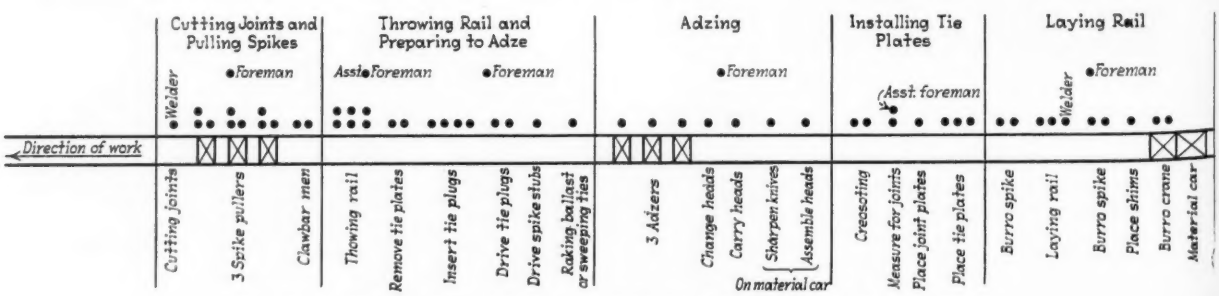
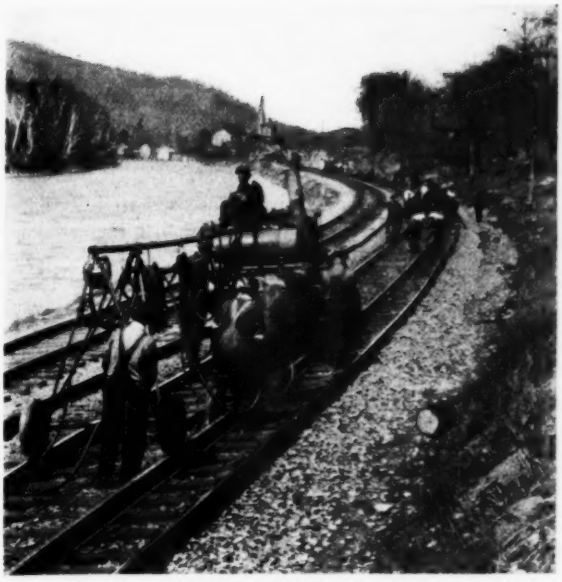


Chart Showing Organization and Equipment Used in the Rail Laying on the Fitchburg Division



Looking Forward Over the Rail Laying Operations, With the Pneumatic Spike Driving Crew in the Foreground

drivers, was split up as follows: One man, with a claw bar, pulling the Burro spikes which had been driven temporarily by the rail laying crew; one man, with a gage and lining bar, barring the rail to gage; four men straightening tie plates; a foreman and six men gaging and gage spiking; a foreman and 18 men setting spikes; a foreman, compressor operator and six men driving the spikes with the air hammers; and two men, with spike mauls, driving missed spikes and straightening cocked plates.

As the work progressed it was manifest that the one man barring the rail to gage greatly facilitated the speed at which the six gagers could work. The flexibility of the organization allowed the number of gagers to be increased to 8 to 10 men when necessary, by taking men from the spike setting gang, without seriously interfering with the operation of this latter gang. The gaging group, as well as gaging, did such lining as was required, as they progressed.

On the days that the track was not being gaged, or, in other words, on the days in which the first line of the old rails was being renewed, the procedure was to spike the new rail by hand at the quarters, ends and centers, on the inside in the old spike holes, and to line between these spikes by eye, to improve the line of the new rail over that of the rail removed. Full spiking was then carried out in a following operation by the crew with the pneumatic spike drivers.

The men operating the pneumatic spike drivers were spread out over a distance of about 25 ft. directly behind the air compressor, three of the men single spiking on the inside of the rail, each man driving every third spike, while the other three men were single spiking on the outside of the rail in the same manner. The hose to the spikers was carried overhead on a pipe carriage or rigging, 23 ft. long, the front end of which was supported on the top of the compressor, while the rear end was carried by a light structural steel frame supported on a pair of flanged wheels which operated on the track. This arrangement not only kept the hose lines out of the way of the tool operators, but precluded the necessity of the men dragging the hose along with them. The effectiveness of the arrangement used is seen in the fact that the whole outfit moved along, driving all spikes, at a uniform speed about equivalent to a slow walk.

Following the application of anti-creepers, which was done in the usual manner with hand tools, the signal bonds were applied. Two types of bonds were used in the work, O-B welded bonds when carbon steel rails were being laid and stranded plug bonds when medium manganese steel rails were being laid. Four welders and two welder helpers equipped with four Oxweld welding outfits, two mounted on each of two push cars, applied the O-B bonds. The installation of insulated joints and wiring in connection with them, was handled by a signalman and helper.

When the stranded bonds were being applied, the signal foreman, two signal men and five helpers making up the gang were equipped with three Everett power bonding drills. It was the intention to keep the third drill as a spare, but the rail laying progressed so rapidly that it was necessary to use this extra drill all the time. The drills worked progressively, each one drilling at every third joint. As was the case with the welded bonds, one signalman and a helper took care of the insulated joints.

Immediately following the bonding came the final operation of the rail laying, namely the dismantling of the old rail. The gang doing this work consisted of an assistant foreman, a compressor operator, one welder and eight men, and was equipped with a four-tool tie tamper compressor with two nut runners and an acetylene cutting outfit. Two men started the old nuts with hand wrenches; four backed off the nuts with the nut runners; the welder burned off frozen nuts and such others as the wrenches could not start; and the final man in the gang knocked the old joints apart so that the rail was ready to be picked up without further handling.

Work Started and Closed Up Effectively

In all of the rail laying work, one line of rail was relaid continuously throughout the day, the opposite rail being brought up the following day. At the start of the day's work, a large number of the men secured mauls, claw

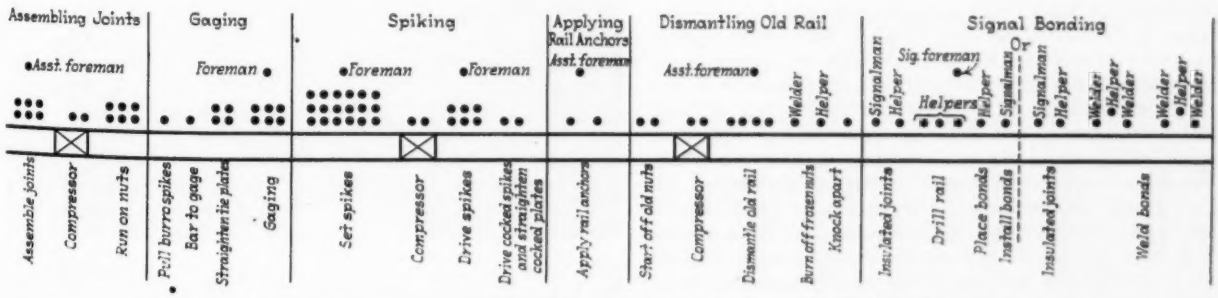


Chart Showing Organization and Equipment Used in the Rail Laying on the Fitchburg Division

bars or lining bars from the supply car and assisted in getting the regular advance gangs well out ahead before dropping back to their regularly assigned positions. In this way all of the men started effective work at the same time, and within about 30 min., the entire force was working smoothly in accordance with the organization for continuous operation. At a predetermined time in the afternoon, usually about 2:30, but depending somewhat on the distance of the work from the camp, and whether the equipment had to be taken back to the point of starting the following day, the advance gang came to a stop, and then, with the men of the succeeding gangs as they came up to the stopping point, fell back into the rear gangs, gaging, spiking, and applying joint bars and anti-creepers, in order to close up the work completely in a minimum of time. Mauls, wrenches and such other tools as were needed by the men in this work were secured from the material car as the men went back to the finishing-up operations.

All of the equipment was set off the track at night near the start of the work for the following day, either on runways supported by tie cribbing along the right-of-way or at station grounds. In several instances, the wheeled equipment was run in on idle yard or station tracks, this being done where possible to avoid the greater work of moving the equipment from the rails. Regardless of where the equipment was left, it was locked and blocked securely, and all exposed engine and motor parts were covered with canvas as a protection against the weather.

One Work Train Used

The rail laying organization on the Boston & Maine was made up of the extra gangs from the six districts of the Fitchburg division, each of these gangs assembling at the scene of operation with its own boarding car equipment and foremen. During the work, the different camp trains were kept together and as near the work as possible, being moved up with the progress of the work as some point ahead proved more convenient or advantageous. Only one work train was employed with the rail laying organization, this train being used to take the men to and from the work, and to pick up the old rails and track fastenings.

The loading of the old rails and fastenings was done just as close behind the dismantling crew as possible. This was effected by a foreman and 18 men with a rail loader located between two gondola cars in the work train. All of the old track fastenings were picked up by hand, classified as to scrap or relay, and loaded on to flat cars.

The distribution of the new rails and fastenings for the rail laying work was done prior to the actual rail laying by a work train. In this work, the rails and fastenings were distributed in two different runs of the train. During the rail run, with an average gang of 20 men, the train was usually made up with an air-operated rail loader and a gasoline-operated locomotive crane, each located between cars of rail; while during the material run, which was made with an average gang of nine men, the train included only material cars.

It was endeavored to confine all rail laying work to 10 hours each day, this including travel time to and from the boarding cars. The total force involved in the work, including foremen, the men bonding, those picking up the old rails and fastenings, and a group of miscellaneous employees such as cooks, timekeepers, watchmen, waterboys and equipment mantainers, ranged from a minimum of 159 men to a maximum of 178 men, and averaged about 173 men. The force engaged only in the actual rail laying operations, that is, the above total force excluding those men picking up the old rails and fastenings and those classed as miscellaneous, ranged from a minimum of 128 men to a maximum of 138 men, and averaged about 133 men throughout the work.

With this force, the rail laying work, which was carried on for 12 days, increased steadily in efficiency. On the first day of the work only 503 rails were laid. The third day the number was increased to 577 rails; the fifth day the number had been further increased to 641 rails; and by the ninth day, the number had jumped as high as 734 rails. The average number of rails laid each day during the 12 working days was 583, equivalent to approximately 22,700 lin. ft. On the basis of 8½ hours of working time, this was equivalent to laying 68 rails an hour, or a rail approximately every 53 seconds. On the day on which the best record of 734 rails was made, the rails were laid at the rate of 82 an hour or a rail approximately every 44 seconds.

The average total cost of laying the rails, including the wages of those men bonding the new rails and dismantling the old rails, and likewise the wages of such miscellaneous employees as cooks, watchmen, waterboys, etc., but not including the wages of the 19 men involved in picking up the old rails and fastenings, was $1.77 a ton. On the day of the best record, the total cost was only $1.58 a ton. Distributing the rails and all fastenings and frogs and switches was done at an average cost of $1.03 a ton under traffic, and the picking up and classifying of the old rails and all fastenings was done at an average cost of $0.96 a ton.

All of the above costs include both labor and equipment charges, the labor charges being figured on the basis of $0.40 an hour, which was paid to the trackmen, plus a relatively higher rate for foremen, assistant foremen, welders and operators. The charges made for the various units of equipment were based on the operating costs of the different units plus depreciation, and varied from about $1.50 a day to $8 a day. Following are the daily charges made against the rail laying work for some of the more important units of equipment employed: Rail loaders and Burro crane, $8 each; air compressors, adzing machines and spike pullers, $4 each; welding and cutting outfits averaged $22 a day depending on the amount of gas and air used; and power bonding drills, $1.50 each. The work train charge was on the basis of $6 an hour.

The rail laying work was planned and organized under the general direction of W. J. Backes, chief engineer, H. F. Fifield, engineer maintenance of way, and J. A. Parant, principal assistant engineer. The work in the field was carried out under the direction of J. F. Collins, division engineer, and H. S. Ashley, assistant division engineer.

A. R. E. A. Committee on Economics of Railway Labor Inspecting Rail Laying Operations on the Pennsylvania at Ben Avon, Pa., on June 15, 1931.

The Fire at its Height

A Disastrous Bridge Fire

Uncertainty surrounds cause of conflagration in treated timber deck of new double-track structure

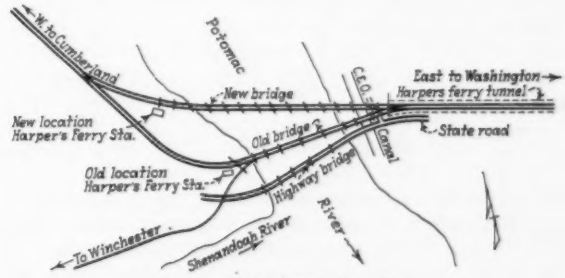
IN SPITE of the most careful investigation, the exact cause and many of the factors contributing to a spectacular and serious fire which caused extensive damage to a new bridge over the Potomac river at Harpers Ferry, W. Va., on the B. & O. on March 6 remains a mystery. This structure, which was of deck plate girder construction with a treated timber deck, was 1,362 ft. long, followed standard practice of design and construction and was built for double track. It was practically completed but had not yet been placed in service at the time of the fire. It is made up of 14 skew spans. In Spans 2 to 13, inclusive (the numbering beginning at the east end), the girders are 100 ft. long, overall, while in Spans 1 and 14, which are not over the river proper, the girders range in length from about 55 ft. to 100 ft. All spans are provided with expansion shoes at one end. The 13 river piers are all of reinforced concrete construction while the abutments are of mass concrete.

Treatment of Timber

The deck of the new bridge is of the open type, with treated timber throughout, consisting of 8-in. by 14-in. long leaf yellow pine ties, spaced 14 in. center to center, and guard timbers and three walkways of the same material. All of the timber used in the structure prior to the fire, after air seasoning and framing, had been treated by the full cell process, using A. W. P. A. specification Grade 1 creosote oil, with a retention of 12 lb. of oil per cu. ft. of timber. Following treatment, the ties were allowed to air season at the treating plant and in the vicinity of the bridge for five to nine weeks before being placed in the structure, although it is reported that free oil was showing on the surface of some of the ties when they were placed in the bridge. The ties had not, however, been dusted with sand, cement or other material to absorb this oil.

The fire started at a point on Span 11, about 325 ft. from the west abutment, during the noon hour while the workmen were at lunch. It was discovered by a group of these men who were immediately at the west end of the bridge at the time and who state that, when sighted, the fire was relatively small, but enlarging rapidly.

The men who discovered the fire, with a group of about 15 or 20 other men, attempted to extinguish it with sand, but, in spite of the fact that they acted promptly and were relatively close to the fire, they were able to do little other than check the spread of the flames westward. Fanned by a strong west wind that was blowing practically lengthwise of the bridge, the fire spread



Layout of the Bridge Location

eastward rapidly, defying efforts to check it until it was stopped at the east end of Span 2. In less than two hours the damage was done. In fact, it is said that the fire had run its full course, about 1,150 ft., in 37 min.

Aided by local and neighboring fire departments and assisted by the direction of the wind, the workmen were able to keep the fire from running westward over Spans 13 and 14, but with no means to attack the fire as it spread eastward, until it approached the east bank, it was soon considered a hopeless fight to save the main

river spans. Attempts were made to break the tracks and deck structure ahead of the fire, but with the rails fully spiked in place and jammed together due to expansion, progress was slow and each time the men were forced to retreat from the advancing heat and flames. Aided by water from fire hose stretched from the east end of the bridge, a partial break in the track was finally made near the east end of Span 1 and the fire was checked there.

Damage Was Severe

That the fire was intense is evident not only by the rapidity with which it spread, but also in the extent to which it consumed the deck timbers and the effect which it had upon the steel. Practically throughout the extent of the fire, except at the ends, the ties were burned deep, the 8-in. by 14-in. original section being reduced to 2 in. by 10 in. quite generally. Likewise, the new 130-lb. rail which had been laid on the bridge was greatly distorted by the heat to which it was subjected.

That the girders of the bridge were subject to intense heat, especially near their tops, is seen not only in the permanent distortion which took place in many of them, but also in the excessive expansion which was witnessed in them during the fire. In spite of the fact that the girders of the different spans were set six inches apart at the ends, it was observed that they came in contact during the fire and some witnesses claim that certain of the girders were seen to arch up as much as eight inches. That the girders came together was verified after the fire by marks which showed conclusively that the ends had been in contact, and that certain of the girders actually arched up as much as eight inches is given credence by calculations which show that such action could have resulted from the heating of the steel to 700 deg. F.

56 Girders Damaged

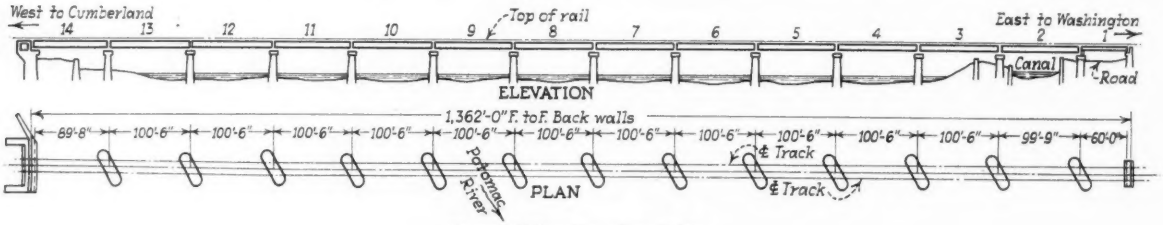
As a result of the fire, 56 of the 100-ft. girders were damaged and the lateral bracing between them was practically destroyed. The extent of the damage to the girders varied considerably, from severe scorching near the top in some cases to other cases where the webs buckled and the girders sagged as much as six inches. As a general rule it was observed that the line of girders on the north, or windward side of the bridge were less severely damaged than the other three lines of girders, toward which the flames were blown.

As a result of the most careful checking of all of the girders affected by the fire, including the measurement of distortion, the calculation of internal stresses set up and the physical and chemical properties of the metal itself, it was decided to renew 30 of the girders. These included all of the girders in Spans 4 to 10, inclusive, and two of the girders in Span 3.

The exact cause of the fire has not been determined definitely, although the possible causes have been narrowed down to two or three. The fire was first noticed at 12:10 p. m. on Span 11, at a point where a gang of riveters, with a coal forge, had been working less than 15 min. before. Between 12 and 12:10 a considerable number of workmen had passed the point on their way westward to lunch, and within practically the same interval a steam locomotive crane engaged on the bridge had passed back and forth over Span 11. Whether a hot rivet, a live coal from the forge, a coal from the crane, or a lighted cigarette stub dropped carelessly by one of the workmen, started the conflagration is a question which may never be answered positively.

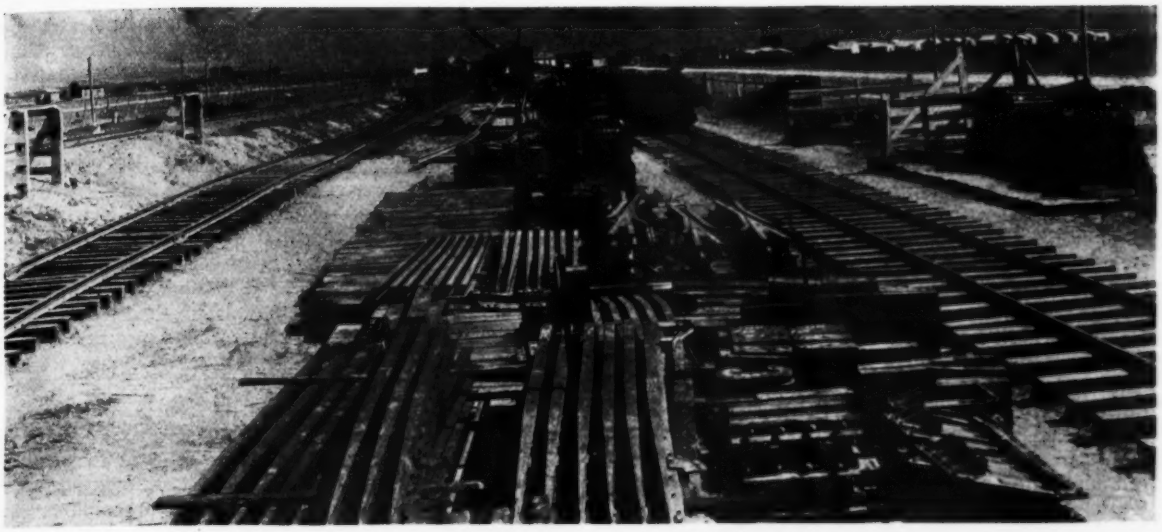
The rapidity with which the flames spread is attributed directly to the intensity and direction of the wind, at the time of the fire, which was blowing from the northwest at about 30 m.p.h., almost in line with the bridge. The reasons for the intensity of the fire and the apparent inflammability of the timbers are not as readily explained. The oil used in treating the timbers was American Wood-Preservers Association Specification Grade 1 which has been standard on the road as well as in general use in the wood preserving industry for a number of years and which has given little concern heretofore as presenting a fire hazard. Whether treatment by the full cell process, with the amount of oil retained by the timber, had any bearing on the intensity of the fire, is another question which has not been answered definitely. Yet, the fact that there is some feeling that it had is indicated by the fact that when renewing the deck structure following the fire, timber treated by the empty-cell or Rueping process with a retention of 8 lb. was used.

After the Fire, Note How the Lateral Bracing at the Left Has Been Damaged



Plan and Elevation of the Bridge

FASTEST TRAIN.—By placing two of its trains on a schedule requiring an average speed of 68.9 miles an hour, the Canadian Pacific now has the distinction of operating the fastest train in the world. The record was formerly held by the Great Western of England.



A Material Yard on New Line Construction

Accountant Asks Care in Reporting Material*

Foremen's lack of understanding and appreciation of requirements found main cause of inventory discrepancies

By H. L. TONKINSON
Assistant Accountant, Kansas City Southern, Texarkana, Texas

EACH year our annual inventory reveals considerable discrepancies between the material actually on hand and that which is carried on our stock sheets as on hand. For this reason, it becomes necessary every year to determine the causes leading to these discrepancies and to give a satisfactory explanation of them. Often it is necessary that we take up in our accounts and charge off in the last month of the year considerable amounts due to inventory shortages. Naturally, it is desirable to remove the causes of the discrepancies in the material accounts and to avoid the force reductions during the closing weeks of the year, which are sometimes necessary as a means of offsetting these shortages in material.

Purpose of Article

Probably the lack of a thorough understanding on the part of some foremen as to the exact nature of the information that is required on the daily work reports in order to enable the accounting forces to account properly for all the material, together with their failure to appreciate the trouble that is caused when material used is reported improperly, are largely responsible for the discrepancies between the actual and stock sheet material balances, rather than carelessness or negligence. The purpose of this paper, therefore, is to give a better understanding of what is required.

All material is properly classified as new, second-hand or scrap, and as 8550, 8521, 100-lb., 80-lb., 75-lb. or 60-lb., etc., with the further classification of rail as No. 1 or No. 2. Every piece of material has a money value, that is, a price, depending entirely on the size, weight, length, number, kind and class of the material Instead, therefore, of merely showing on reports that one angle bar, four bolts, one 15-ft. frog and one rail were used, they should be shown as one second-hand 8521 angle bar, four new 85-lb. bolts, one second-hand No. 10, 15-ft. 8521 spring frog, and 33 ft. of second-hand No. 1, 8521 rail, etc., giving detailed descriptions so that each piece of material can be charged out at the proper price, and deducted from that particular kind and class of material on the stock sheet.

Rail Account Shows Greatest Shortage

Our second-hand rail account generally shows the greatest shortage on inventory, and it is believed that this is due chiefly to one or more of the following causes: First, where a considerable quantity of rail is used at one time, it is not all reported on the daily work reports, as the engineers' checks on new tracks invariably disclose some discrepancies in rail and other material used; second, improper classification of rail used and released, such as reporting a 31-ft. rail released from the main line as 3 ft. of scrap rail and 28 ft. of second-

*Abstract of a paper presented before a recent meeting of the Kansas City Southern Maintenance of Way Association.

hand No. 1 rail, and at a later date using the same rail in some back track and reporting it as a 31-ft. second-hand No. 2 rail used, thus charging out 31 ft. of rail as second-hand No. 2, when it had been previously reported and taken into stock as 28 ft. of second-hand No. 1 rail and 3 ft. of scrap; third, improper checking and reporting of all new and second-hand material that is received from or shipped to another district, or delivered to any industry on sales orders.

A transaction, such as that noted in the second case, involving the reclassification of one rail, will make the inventory short by 28 ft. of second-hand No. 1 rail and 3 ft. of scrap rail, and at the same time the second-hand No. 2 rail will be 31 ft. over. Also, if a number of defective rails are released as No. 2 rail, and at a later date are reclassified and sold as scrap rail, the scrap rail account will be over on inventory and the second-hand No. 2 rail will be short by that amount. What has been said about the proper checking and classifying of rail applies to all other material.

Show Where Material Is Shipped

When foremen load any kind of material for shipment, it is difficult to get them to show the destination of that material on their daily work reports, and it is necessary in almost every case to get a correction on their reports. Yet, if they realized that the account to which the labor for "loading material" is charged depends on the destination of the material and the purpose for which it is to be used, involving one of four or five different accounts or one of three or four different departments, they would never charge time to "loading material" and fail to show on their reports where that material was to be shipped. When scrap is being loaded, either the track department or the car department is involved, and, unless foremen show on their reports whether track scrap or car scrap is loaded, it is necessary to secure a correction on that report in order properly to dispose of the labor charge.

When a frog is charged out that needs only a dozen new bolts, a new piece of wing rail and the point built up, many foremen have the erroneous idea that it should be reported released as "second-hand," with the idea that it is too good to be classed as "scrap." This is incorrect as all switch material that is released to be repaired should be reported as "scrap" when released. A scrap value is then placed on that material, and when it is reported as repaired by the welder, it is taken back into stock as "second-hand." It is then proper to charge this material out as "second-hand" or "repaired" when it is again placed in service.

Show Labor Charge but No Material

Many reports come to the office with a labor charge for changing out rail, angle bars, renewing spikes, bolts, etc., yet no material is reported as used or released, which evidently is an oversight or error, and a form "H" sheet requesting corrections is always sent to the roadmaster in such cases. A report was received recently from a foreman, which made a charge of 14 hr. to changing off angle bars, yet no angle bars were reported as used or released. A form "H" correction sheet, which was sent to the roadmaster, was returned with the statement that two second-hand 85-lb. angle bars were used and two scrap angle bars were released. It is hardly possible that in the course of a regular day's work any foreman is going to consume 14 hr. "changing off angle bars" and use and release only two.

When material is used and not reported, particularly small items, such as spikes, bolts, angle bars, etc., the cost amounts to a considerable sum when the entire line is considered. If each foreman should use 10 new spikes a month for the entire year and fail to report them, a shortage of 6,000 lb. or 3 tons would be created, which, at our present price of $3.25 a 100 lb., would equal $195. Also, if each foreman should use and fail to report five new 85-lb. bolts a month for the entire year, a shortage of 5,700 lb. of bolts would be created, which, at our present price of $4.64 a 100 lb. would equal $264.48. New 85-lb. angle bars are worth 96 cents each, reformed angle bars 77 cents each, and second-hand angle bars 43 cents each. Thus, the extent of the shortage that would be created if each gang should use and fail to report an average of one angle bar a month for the entire year becomes readily evident.

It is especially important to report correctly all material used in A.F.E. work, and also all material released from spur tracks that are retired. Not only is this required by the management for its own purposes, but the Interstate Commerce Commission requires that the management furnish a complete and correct detail description of all labor and material expended.

Report Names Correctly

It is not possible to place too much stress on the importance of reporting correctly the names of all laborers and whether they are white men or negroes, always using the same name in the same way for each individual and never using nicknames. There are a number of different records kept, both in this department and in the personnel department, of each individual employee, such as the personal record, the group insurance record, the board deduction record, the watch deduction record, etc., and it is very confusing when an effort is made to check up on an individual's past record only to find that he has been carried as, say Sam J. Brown, Sam Brown, Jay Brown, S. Brown, Jim Brown, Son Brown, etc.

Importance of Right Spirit

Constructive criticism is always helpful when received in the right spirit, and we trust that everyone concerned will consider seriously this opportunity to inform themselves on the importance of making proper reports, and resolve henceforth to render more efficient service in every possible way, to the end that discrepancies in our material stocks may be eliminated or reduced to the minimum, and the unpleasant consequences of such discrepancies avoided.

R. D. Garner, Chief Engineer, Central Vermont, Inspecting Track Ballasted with Crushed Vermont Granite

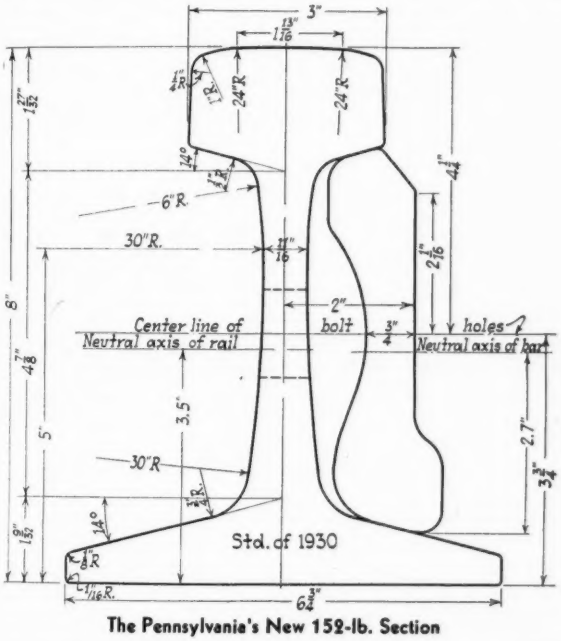
Pennsylvania Adopts New 152-lb. Rail Section

By T. J. SKILLMAN

Chief Engineer, Pennsylvania System, Philadelphia, Pa.

PROBABLY the most interesting development in rail design in recent years is that announced by the Pennsylvania of its 152-lb. section, the first heats of which were laid during May and June of the present year. Aside from its technical significance, the production of this rail, which is the heaviest and stiffest in regular use on any railway, constitutes an event of historic interest, since 1931 completes an even century in the evolution of the T-rail.

The new 152-lb. rail was designed to meet the demand for a stronger track structure, which would also have smoother and more comfortable riding qualities, capable



The Pennsylvania's New 152-lb. Section

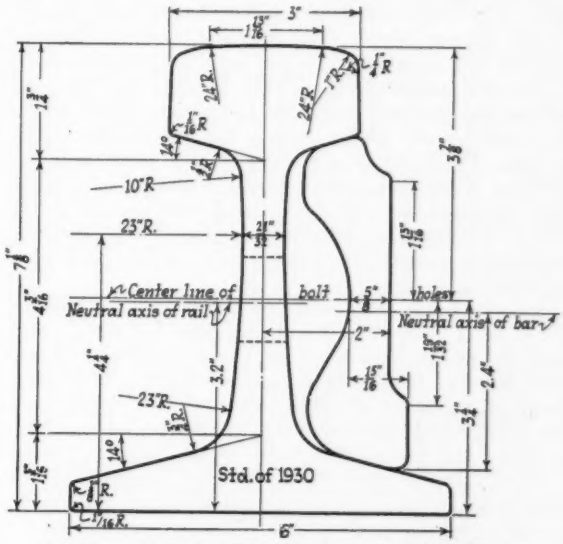
of carrying safely increased traffic producing greater wheel pressures, at higher speeds, and which at the same time would result in more economical maintenance. As a result of studies, it was determined that the proper objective was a rail that would safely and satisfactorily withstand an axle load of 100,000 lb. moving at a speed of 100 m.p.h. This contrasts with an axle loading of 80,000 lb. moving at a speed of 80 m.p.h., which was the service for which the 130-lb. rail was designed that has been standard on the Pennsylvania since 1916. It was also demonstrated that it would be necessary to incorporate the following features, among others, in the design.

1—A height of approximately 8 in., which is 1⅜ in. higher than the 130-lb. section heretofore the standard on this road, as an important element in increasing the stiffness of the rail.

2—A head designed with a radius as great as would be practicable from a manufacturing standpoint, in order to give a broad contact with the wheel tread.

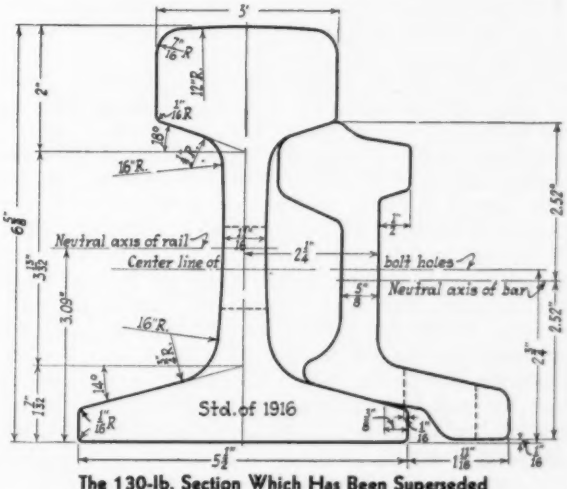
3—A definite desirable ratio of the perimeter of each part of the rail—that is, the head, the web and the base—to their respective volumes, so that the rate of cooling of all of these parts should be as nearly even as possible, in order to minimize the creation of internal stresses as a result of cooling.

4—Provision for canting the rail, and that this should be done in the ratio of 1:40 by the use of a canted tie plate, as a further means of insuring a better contact between the head of the rail and the tread of the wheel.



The New 131-lb. Rail Which Replaces the 130-lb. Section

In developing a design to meet all of these requirements, there was produced a section weighing 152 lb. to the yard, which has 75 per cent greater stiffness than the 130-lb. section used previously. The investigation of the most desirable shape of the head to provide a running surface in which the initial stress will be held to a minimum, included a study of the contours of the



The 130-lb. Section Which Has Been Superseded by the 131-lb. Section

wheel treads on a large number of cars in active service and the determination of the average contour of those studied. From this study, it was found that a radius of 24 in. most nearly fit the average contour that would be practicable to roll. Observation of the behavior of the rail in the track up to this time indicates that the contact between the running surface of the rail and the wheels has been extended materially, as compared

with other rail sections, so that it is believed that this objective has been attained.

The chemical composition of the new rail is as follows: Carbon, 0.70 to 0.85; manganese, 0.70 to 1.00; phosphorus, 0.04 or under; silicon, 0.15 to 0.30.

As a result of the knowledge gained in designing the 152-lb. section, the 130-lb. section has been redesigned to accord with the principles of the new design. The result of this revision has been a section having 22 per cent greater stiffness, with an increase of only 1 lb. in the weight per yard. The new 131-lb. section will supersede the 130-lb. section and hereafter will be the standard for main-line track, except where the conditions of traffic require the use of the 152-lb. section. The latter is now being laid at various points between New York and Pittsburgh, and its use on the main east and west and north and south stems of the system will be extended progressively, to replace existing lighter sections, as conditions of traffic and wear warrant.

Reference has been made to deficiencies in splicing. These were met by utilizing the greater fishing space provided by the higher web of the new section. It was thus possible to design a simpler but more effective form of splice which it is believed will result in a much improved rail joint. In particular, features have been introduced into the design which produce greater vertical stiffness, as well as lateral resiliency. The latter makes it possible to take up the wear that occurs between the underside of the rail head and the top of the splice.

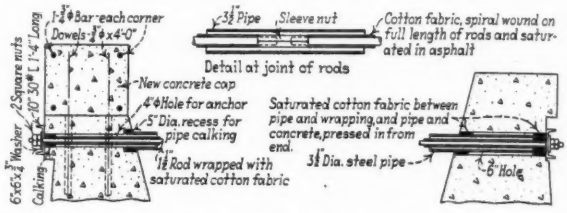
Use Tie Rods to Strengthen Retaining Wall

THE adding of a running track along the south side of its Galena division four-track elevated main line in Chicago made it necessary for the Chicago & North Western to raise the retaining wall along the south right-of-way line between Sangamon street and the alley west of Peoria street, a distance of 80 ft. The increase in the height of the wall was of no particular consequence and was readily accomplished by adding a concrete coping that was held in place by two rows of ¾-in. by 4-ft. dowels placed 2 ft. apart in holes drilled in the top of the old wall. However, the wall, which was about 30 ft. high to bottom of footing, had been designed for a condition of loading under which the nearest track had its center line 22½ ft. from the face of the wall, whereas the construction of the new track imposed the surcharge due to the loading on a track only 9½ ft. from the face of the wall. Consequently it was decided that the wall had to be strengthened to resist the increased lateral pressure, in addition to receiving the concrete cap or coping.

Walls Were Tied Together

This was done by tying this wall to the wall along the north side of the right of way, about 80 ft. distant by means of tie rods. Eleven 1½-in. rods spaced 7½ ft. apart were provided. They were placed at an elevation that caused them to pass through the old coping of the south wall and just under the coping of the north wall. This location insured that the rods would miss two electric conduit duct lines buried in the embankment.

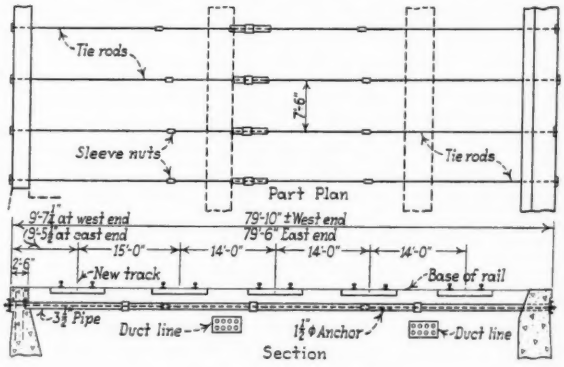
To place these rods, a six-inch hole was drilled through the north retaining wall at the location of each rod, using a portable scaffold resting on the adjacent street. Following this, a 3½-in. copper-bearing wrought-steel pipe was entered into the hole and forced through the embankment by a special pipe jack, the entering end of the pipe being protected by a tapered nose that was screwed on the pipe. The pipe was purchased in random lengths (16 to 20 ft.) and additional lengths were screwed into place with standard couplings as the jack-



Details of Work

ing progressed. When the forward end of the pipe had been driven to within six inches of the rear face of the south retaining wall, jacking was stopped and a four-inch hole was drilled in the south wall in line with the pipe.

The tie rods, in lengths of 29 and 30 ft., were connected in three sections by means of special hexagonal sleeve nuts 9 in. long tapped with right-hand threads for their full length. These rods were wrapped with cotton fabric saturated in asphalt, using a spiral winding and covering the rods completely to a tight fit against the sleeve nuts. After the rods had been inserted in the pipes, some of the saturated cotton fabric was used to calk the annular spaces between the pipe and the wrap-



Cross Section and Part Plan

ping of the rods and between the concrete of the wall and the pipes so as to seal up the holes where the rods passed through them.

Some pieces of second-hand 10-in. 30-lb. channels with 2¼-in. holes in the webs were cut to lengths of 1 ft. 4 in. to be used as bearing shoes against the outside faces of the retaining walls, and with the placing of these and some plate washers 6 in. square by ¾ in. thick, and the turning up of two 1½-in. standard square nuts on each end the installation was complete.

The same plan was applied to the walls in two other blocks in the same territory, a total of 35 tie rods being applied in the three blocks. We are indebted for the information presented above to O. F. Dalstrom, engineer of bridges, Chicago & North Western, under whose direction this plan was developed and carried out.

Jacking a Conduit Through Water and Sand

SLOW orders were avoided and a marked saving in construction costs was obtained by employing the jacking process in place of the open-trench method in installing a 36-in. water main under three four-track main lines which parallel the shore of Lake Michigan near Hammond, Ind. The pipe was placed at an elevation 14 ft. below the lake level.

The water main was required to supply water from the lake to a large soap-making plant, located south of the tracks, and it was proposed to install the pipe under the tracks by the open-trench method. However, C. V. Potter, assistant engineer on the Pennsylvania, who had had previous experience with the Armco jacking method of installing culverts and conduits, recommended the use of this method as a means of avoiding greater expense and objections to open-trench construction with falsework under the 12 tracks. His plan was to drive a line of 66-in. corrugated iron culvert pipe under the three embankments and then use this as a conduit in which to place a 36-in. standard water pipe. After a study of this plan by a representative of the soap company and the railroads it was adopted. The other railroads involved are the New York Central and the Baltimore & Ohio.

Installation

For the installation under the three lines, it was necessary to excavate four working trenches. The unstable nature of the sandy soil required that these trenches be well sheeted and strongly braced. The method followed in excavating was to jet the sheeting on the two sides and face of the proposed trench. The material within the confines of the sheeting was then removed by means of a clamshell and the necessary wales and struts were inserted as the excavation progressed.

As the pipe was to be placed 14 ft. below the level of the nearby lake and because of the sandy nature of the soil, water was present in large quantities and it was necessary to lower the watertable and thoroughly dry out the surrounding soil before jacking operations could be started. This was done by using a system of two-inch well points placed at intervals of two feet on both sides of the proposed line of the pipe. To place these well points, a two-inch jet pipe was forced down through the sand to form a hole for each well point. When the jet was forced down to a sufficient depth, it was withdrawn and the well point quickly shoved into place before the material from the sides had time to fill up the hole. Each well point was then connected to a suction line which in turn was joined to pumps that maintained a sufficient vacuum to keep the soil surrounding the working area sufficiently dry to permit the successful completion of the job.

When excavation was completed to the desired depth, guide timbers were set to the required line and grade in the bottom of the trench, and a backstop was erected at the rear of the working trench. As the sections were jacked into place, additional sections of pipe were lowered onto the lining timbers and connected to the sections previously jacked by means of a field-riveted joint.

In spite of the system of well points, the sandy soil did not arch effectively and would grip the pipe. Consequently it was inadvisable to attempt the jacking of the complete line from one setup. The method used to overcome this difficulty was to jack a line from each side of the embankment and join the two lines approximately in the center. By carefully determining the grade and line of the guide timbers, this meeting of the two lines was accomplished satisfactorily in every case except for two of the longer lines where it became necessary to jack 60-in. and 54-in. diameter pipes in succession through the 66-in. pipe already in place. By following this practice, the required openings under all three of the railways were completed.

Laying the Main

Once the conduit was in place two lines of rails, placed so as to center the water main, were laid within the pipe. The 12-ft. sections of the 36-in. cast iron main were then lowered onto the rails in the working trench and jacked into the conduit as additional sections were added and the joints were made.

In order to avoid the possibility of any future settlement of the roadbed, the railroad officers specified that the space between the water main and the conduit should

A Progress View, Showing Sheeting, Well Points, Tunnel Pipe and Water Main

be backfilled with sand. This was quickly done by shooting sand into the opening between the two pipes by means of an air jet. The force with which the sand was blown into place gave the necessary solidity to the backfill, and effectively eliminated the possibility of any settlement. The remainder of the intake was laid by the open-trench method.

A comparison of the estimated cost of making the installation by the open-trench-falsework method and the actual cost of jacking showed a saving of approximately 66 per cent in favor of the latter. This figure includes only the actual cost of construction, and does not take into consideration an increase in operating costs by reason of slow orders, or the cost of maintaining the tracks until the roadbed became consolidated.

The actual jacking of the conduit under the three tracks was executed by a subsidiary organization of the Ingot Iron Railway Products Company, Middletown, Ohio, which supplied the pipe.

Using Specific Accidents to Formulate Rules

Report of Committee on Non-Train Accidents of the Safety Section, A. R. A., contains valuable suggestions

AS ITS report at the annual meeting of the Safety Section of the American Railway Association, which was held at Chicago on May 19-21, the Committee on Non-Train Accidents presented a compilation of specific types of accidents, together with an explanation of the steps that have been taken to avoid similar accidents in the future. The following excerpts from the report of the committee are of particular interest to maintenance of way forces.

Dragging Draw Bars

The following cases were reported by the superintendent of safety of the Wabash.

"It was formerly the case on this road that a large number of trackmen were injured as a result of starting and attempting to board motor cars from the side. In order to eliminate this form of accident we have established a positive rule that the trackmen starting the car must do so from behind and also board it from that direction. Since the adoption of this rule, accidents of this character have ceased.

"In the hauling of trailers by motor cars a number of serious accidents have occurred as a result of the connecting bar between the motor car and the trailer becoming detached at the end fastened to the motor car. When this happens, the free end of the bar drops down between the ties and causes the derailment of the trailer, often resulting in the injury of any employees who, by reason of necessity, happen to be riding on the trailer. To counteract this source of injury we have placed in effect a rule requiring that the connection of the draw bar to the motor car be positively secure, and that the opposite end of the bar be detachable. With this arrangement, if the connecting bar becomes detached and drops down, it would merely drag along the ties and cause no harm.

"Formerly a large number of eye injuries were caused as the result of employees neglecting to wear goggles when necessary, regardless of the fact that the goggles were furnished and that there were rules requiring their use. Now at nearly all points when employees are found violating this rule they are laid off for from three to ten days, and as a result trouble from this source has been eliminated.

"If an accident occurs on the Wabash that is likely to take place at any other point on the system, a bulletin, describing the accident and suggesting a preventative for future accidents of the same type, is distributed to the particular class of employees involved."

The general safety agent of the Chesapeake & Ohio contributed a list of safety practices that has recently been adopted for use on this road, among which the following are applicable to maintenance of way work.

1. The loading of rail in cars at the rail mill is done so that it lays workwise with a strip between each layer to prevent accidents while unloading.
2. The capacity of each motor car is stenciled on it to prevent overloading.
3. Trackmen scaling cliffs are supplied with life lines.
4. Track forces are furnished with first aid kits containing vaseline for use when handling creosoted timber.

Sawing Off Pile Heads

The following instance was contributed by the manager of the safety department of the Chicago, Milwaukee, St. Paul & Pacific.

"A bridge and building carpenter was sitting on a scaffold which had been swung beneath a bridge and was sawing off a pile head. When the cut was nearing completion the carpenter called for a line to be attached to the pile head to prevent it from falling onto the scaffold. The line was applied and as the pile driver engineer took up the slack in it the pile suddenly broke at the cut, the lower portion springing over and striking the scaffold. The carpenter fell 32 ft. and fractured his back. After this accident, the following rule was placed in effect:

> While sawing off a pile, the pile head must be securely held by a line so that it cannot fall upon the scaffold or men working on the scaffold. Before beginning to saw off a pile, it must be braced or tied below the proposed cutoff so that it cannot spring over and strike the scaffold or the men working on it.

"This rule was printed in the form of a sticker and distributed to all employees having books of safety rules with instructions to paste in the proper place. As a result we have had no more accidents of this nature.

"We were having a considerable number of personal injuries, particularly in the large extra gangs, resulting from the manner in which claw bars were used when spikes were being pulled. Some of the injuries were caused by particles of steel breaking off the heel of the claw bar or from the spike maul or sledge used in driving the claw bar under the head of the spike. Still others resulted from hands being mashed between the bar and the opposite rail. In an effort to prevent further injuries from these causes, several thousand copies of a picture poster and the same number of special circulars were distributed to all supervisors in the track department, and contained instructions to the effect that the claw bar must not be driven under a spike head, but should be thrown under it according to the illustrations contained in the poster. The poster also depicted the proper position of the hands on the claw bar so that there would be no possibility of injuring the fingers. While at one time there were quite a number of injuries in the track department that were attributable to the method of handling the claw bar, these cases now have been practically eliminated."

The vice-president of the Reading reported the following instance.

"One of our welders laid down his electrode after removing his hood and the resulting flash irritated his eyes, causing him to lose time. In order to avoid further accidents of this nature, we immediately furnished each electric welder with goggles to be worn under the helmet or hood. We insist that each man wear these goggles in addition to the helmet or shield, so that if he lays down the electrode after removing his hood any flash that should happen to occur would not injure his eyes."

Prohibits Spiking Across the Rail

The supervisor of safety and personnel of the Belt Railway of Chicago reported several cases involving trackmen as follows:

"A trackman received an injury to his foot when it was struck by a spike maul, and, although an investigation failed to ascertain the cause, it did develop that he and a helper were both driving spikes, and that the injury was the result of the helper working from between the rails and driving spikes on the outside of the rail. His maul either missed the spike or glanced off and struck the foot of the trackman. We now prohibit the practice of driving spikes from the opposite side of the rail.

"Many trackmen on this road have received injuries to their hands when pulling spikes with a spike maul, as a result of the head of the spike slipping out of the jaws of the bar and causing fingers or hands to be pinched between the bar and the opposite rail. All such bars now have a brass ring welded to them at a distance of four inches from the end opposite the claw, and men using the bars are instructed to grip the bar below this ring. The bar will strike the rail only above the ring.

"Flying pieces of steel from spike mauls or track chisels have caused the injury of many trackmen, and as a means of overcoming this trouble we have fitted all track chisels with a piece of old air brake hose, which extends from ½ in. to ¾ in. above the head of the chisel. As a means of reducing accidents at grade crossings, all motor car operators have been advised that it is a dischargeable offense to either strike or be struck by automobiles or other vehicles at grade crossings."

The following case was contributed by the claims attorney of the Delaware, Lackawanna & Western.

"A motor car and trailer carrying a work gang were passing a fast freight train in double-track territory without reducing speed, and struck and injured fatally a trackman who did not hear the motor car. Following this accident a rule was issued requiring all motor cars to be operated at a low rate of speed when passing trains, and to be under such control as to allow them to be brought to a stop in an emergency.

"Two employees were working between the tracks of a double-track deck-girder bridge. Both were on their knees, one on the end of the ties of each of the tracks, and were manipulating a wrench in such a manner that each in turn could pull on it. The wrench slipped and caused one of the men to fall headlong between the tracks to strike in a creek bed 25 ft. below. This practice is now positively forbidden."

Accidents at Crossings

The superintendent of safety of the Louisville & Nashville made the following comment.

"One of the problems which faced us at the beginning of our safety work was that offered by collisions occurring between motor cars and automobiles at grade crossings. They were numerous and generally classed by supervisory officials as unavoidable. In 1929, after giving the matter detailed study, we issued the following instructions, copies of which, printed on cardboard, were placed in every tool and motor car house on our system.

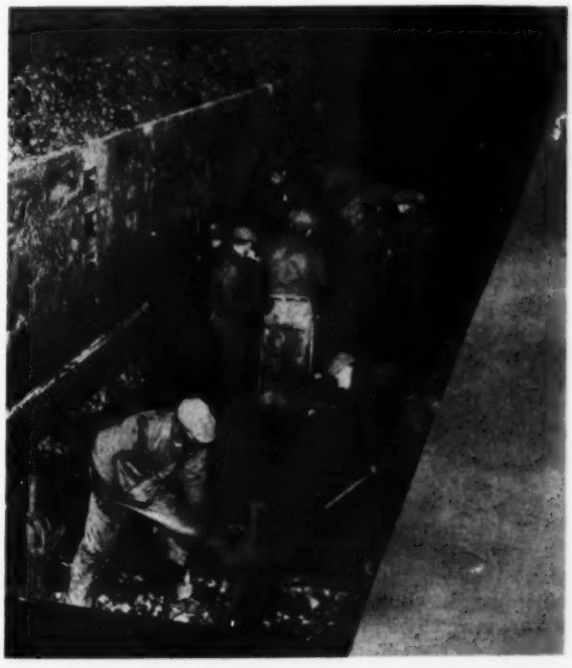
This rule supersedes all rules and special instructions in conflict therewith.

Motor, velocipede, hand and truck cars must approach highway or street crossings at grade at a speed not to exceed six miles per hour and before crossing, cars must be brought to a complete stop, unless an unobstructed view of at least 200 ft. can be had along the highway or street in both directions. If the crossing is protected by a flagman, the operator must get a signal from him before proceeding. When the rails are wet or frosty a much greater distance is required in which to stop the car and the operator must take these conditions into account. A vehicle on the street or highway has the right to cross ahead of a motor, velocipede, hand or truck car, and when the two types of vehicles are approaching a crossing at the same time the vehicle operating on the track must stop and permit the other to cross. Station platforms and persons or animals near the track must be approached under full control. Be prepared to stop if necessary.

"The effect of this ruling, which has been rigidly enforced, has been practically to eliminate this class of accidents, and during the entire year of 1930 there was only one such accident."

Lowering Six Miles of Track in Six River Tunnels

LATE in 1929, the Pennsylvania undertook a most difficult and delicate task at New York in the lowering of the tracks in its two tunnels under the North river and its four tunnels under the East river to provide adequate clearance for the pantograph operation in the 11,000-volt, a.c., overhead electrification system which is being installed between its Sunnyside Yards, Long Island, and Manhattan Transfer, New Jersey, through the Pennsylvania station, New York. Although



Removing Ballast and Readjusting the Ties in One of the Tunnels—Note Excess Ballast Piled on One of the Bench Walls

confronted with many obstacles and difficulties in the form of close clearances, third-rail electrification and frequent and high-speed train operation, this work has now been completed, having involved the lowering of approximately six miles of tracks and the removal of about 20,000 cu. yd. of ballast.

The north and south tunnels, or tubes, under the North river, which extend from the New Jersey meadows to Manhattan Island, are each 13,400 ft. in length and are of concrete and brick ring construction, except directly under the river where the construction consists of cast iron segment rings bolted together and lined with concrete. Each of these tunnels carries a single track on crushed stone ballast passing a 2½-in. ring. The East River tunnels, which vary in length from 13,350 ft. to 14,290 ft. are single-track structures, in general similar to the North River tunnels, with the tracks carried on crushed stone ballast, except for a relatively short section in the two more southerly tunnels where a concrete roadbed, similar to that used in subway construction, was provided.

In the design of all of the tunnels, consideration was given to the possibility of overhead electrification, and not only was adequate overhead clearance provided for catenary construction and pantograph operation, but supports were actually provided in the crowns of the tunnel arches to hang the overhead contact system in case such a system should be decided upon at a later date. In the initial electrification, however, a 650-volt, d.c., third-rail contact system was adopted. With this system, overhead clearance was not a problem which had to be watched closely, and gradually through routine track maintenance and surfacing work the tracks were raised to an elevation which, combined with a certain amount of irregularities in the roofs of the tunnels, and an increased height of rail section, would not permit pantograph operation. Investigation showed that a clearance of 15 ft. 8 in. was necessary above the top of rail, 32 in. either side of the center line of track, and that in order to secure this, it was necessary to lower the tracks from two to eight inches at certain points in all of the tunnels.

Large Force Employed

The lowering operations were undertaken in one tube at a time, progressing from one end to the other, and completely resurfacing the track as the work progressed. The main difficulties involved were the density of traffic in the tunnels, which for all six tunnels together averaged about 748 trains a day, and ran as high as 877 trains a day; the narrow width of the tunnels between bench walls, which at most places was only about 11 ft. 8 in.; and the presence of the third rail, which required care on the part of the trackmen in the use of metal tools. The work was carried on eight hours each night, but because of the density of train movement, which made it impossible to carry on actual lowering operations under traffic, this latter work was done only between 2 a.m. and 5 a.m., the period of lightest traffic, when the track was given over to the track forces.

In carrying out the lowering operations, which was done by the light furnished by clusters of electric lights, about 110 men were employed. These men were divided into four gangs; a gang of about 20 men which kept ahead removing the ballast from the tie cribs, and three other gangs, with about 30 men each, which were employed in removing the excess ballast from the roadbed. In order to keep operations concentrated and yet prevent bunching of the men, each of the lowering gangs was assigned about 100 ft. of track at a time, the different sections being continuous with each other so that only one run-off would be necessary at the close of the working time.

The cribs were cleaned out either by the advance gang or the gang as a whole under traffic during the relatively light traffic hours just prior to 2 a. m. The actual lowering operations consisted essentially of jacking up the track, bunching all of the ties in a panel at one end of the rail, digging out the ballast in the exposed roadbed to the required depth and leveling off the roadbed, respacing the ties, letting off on the jacks, and then screening and replacing the ballast in the tie cribs and on the shoulders. Proceeding in this manner, each lowering gang closed in with the work of the gang ahead, so that rapid, continuous progress was made without one gang interfering with the others.

Where the track had to be lowered less than four inches, the work was completed in one operation, but where the amount of lowering was in excess of four inches, it was necessary to effect the lowering in two distinct steps. This was necessary because of the inadvisability of permitting a run-off in excess of four inches in the high-speed tunnel tracks, and also because of the lack of space available to store the ballast removed from the track where a drop of more than four inches was required.

Ordinary track jacks were used in the track raising, and ordinary track shovels and ballast forks were used in removing the ballast and in cleaning that portion put back in the tie cribs and track shoulders. Because of the lack of room along the sides of the track, all ballast removed from the roadbed was piled up on one of the bench walls along the sides of the tunnels, leaving the other wall free and unobstructed at all times for use as a walk way in case of emergency. This made shoveling more difficult than it would have been ordinarily, and likewise, the forking of such of the ballast as was replaced in the track, but the benches proved handy under the circumstances and facilitated the loading of the surplus ballast into cars later. Contrary to what might be expected in the case of tunnel tracks carrying only passenger trains, the ballast practically throughout was dry and dirty, which made the forking work and a certain amount of the shoveling work, dusty and disagreeable.

All of the men walked to and from the site of the work in the tunnels each night, along the tops of the bench walls, and, outside of the three hours of actual lowering work each night without traffic interference, were employed in skeletonizing the track. Working along these lines, from 200 lin. ft. to 300 lin. ft. of track was lowered each night, depending largely upon the depth to which the ballast had to be removed. While the night force left the track in condition for full speed train operation, final surfacing and lining work was done by a day force of about 20 men, working under traffic.

Removal of the excess stone piled on the bench walls was done about once a week, when a 12-car train of low-side gondola cars was run into the tunnel. On the nights that these trains were run all of the men were employed in loading the stone so that a maximum of work could be accomplished in the relatively short time that the track was available for use by the work train. Altogether, about 400 cars of ballast were removed in the six tunnels, each car holding approximately 50 cu. yd.

All of the work was done under the general direction of the chief engineer maintenance of way of the New York zone, and J. C. White, division engineer of the New York division. The actual work was carried out under the direction of P. X. Geary, track supervisor.

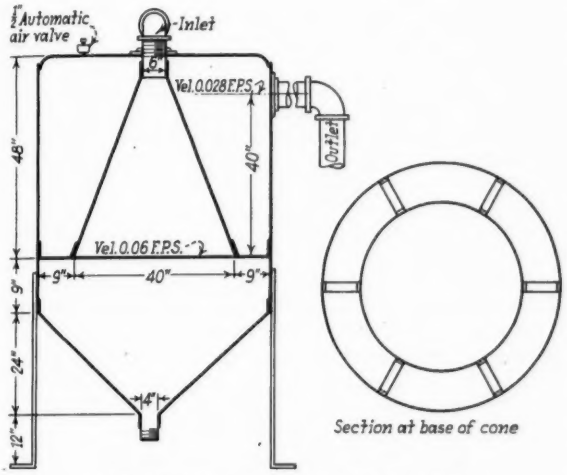
Sand Trap Clears Water

By R. L. HOLMES

Engineer of Water Supply, Texas & Pacific, Dallas, Texas

IN THE operation of a water-treating plant of the zeolite type, it is important that the water shall flow freely through the zeolite bed and that during its passage all of the water shall come into contact with the zeolite. Since the zeolite bed is of such a character that it acts as a filter for suspended matter, these requirements make it necessary that all suspended matter be removed from the water before it reaches the zeolite.

In operation of one of our zeolite water-treating plants, we experienced trouble with sand, the grains of which ranged from extremely fine to medium size, that was pumped from the wells which provided the water supply.



Vertical and Horizontal Sections of Sand Trap

To protect the zeolite bed and prevent obstruction to the free flow of the water, it became necessary that we devise some method for removing the sand from the water.

To do this, we constructed a sand trap, which has now been in service for two years with excellent results. The trap, which is based on the principle of a dust collector, such as is sometimes installed between the breeching and stack of a boiler plant, consists essentially of a cylinder, 57 in. long and 58 in. in internal diameter, made from an old boiler shell. The upper end is enclosed, while a conical bottom, 25 in. deep, is appended to the lower end. The whole assembly is mounted on eight legs of such length that the bottom stands clear of the floor. The top of the cylinder is tapped for a 6-in. inlet pipe, from which a cone, 48 in. long, having a base diameter of 40 in. and constructed of 16-gage iron, is suspended. The water enters the top of the cone with a velocity of 2.75 ft. per sec., equivalent to about 15,000 gal. an hour, which is reduced to 0.06 ft. per sec., at the bottom of the cone and to 0.028 ft. per sec. at the elevation of the outlet.

An outlet is provided slightly below the upper end of the cylinder. The 9-in. annular space between the bottom of the cone and the outer shell has the same area as that of the cone at this point, so the velocity of upward flow is the same, 0.06 ft. per sec., as the minimum velocity of downflow, and this decreases to 0.028 ft. per sec. at the level of the outlet. The operating pressure on the trap ranges from 24 to 32 lb. a sq. in.

It is our practice to flush the trap twice daily by means of a 4-in. quick-opening valve which is placed at the lowest point in the conical bottom. In doing this we remove from one or two ounces to as much as a half pint of sand each time. The accompanying table gives the grading from actual tests, made to determine the fineness of the sand removed. It would be possible to remove a larger amount of the finest material, but this would require a larger cone and cylinder to still further reduce the velocity of the water.

Grading of the Sand Removed from Sand Trap

	Per Cent
Passing 10 meshes and retained on 40 meshes	11
Passing 40 meshes and retained on 80 meshes	61
Passing 80 meshes and retained on 100 meshes	10
Passing 100 meshes and retained on 200 meshes	14
Passing 200 meshes	4

In constructing a trap of this character, it is important that the net area of the cylinder equal or exceed twice the area of the base of the cone, and that the base of the cone lie in a truly horizontal plane.

Use Timber Foundations For Crossings

By R. S. WELCH

Division Engineer, Baltimore & Ohio, Cincinnati, Ohio

THE maintenance of good line and surface at railroad crossings is one of the annoying problems of maintenance of way officers. Proper alinement can usually be insured by the application of sufficient rail anti-creepers and by relining when necessary, the latter being a comparatively inexpensive operation. On the other hand the maintenance of surface is usually both difficult and expensive, especially if the crossing is located in a paved street. Frequently in such cases, drainage conditions are unfavorable, and when more than a single crossing is involved the situation is often perplexing.

If good drainage cannot be secured, the crossing frogs soon begin to work under traffic, joints begin to pump and it is difficult to keep bolts tight. With the crossing in this condition it is only a question of time before cracks develop in the flangeways at the frog points, the bolts shear and, in some cases, the exterior arms break owing to the unusual bending stresses.

With the idea of providing a semi-rigid crossing foundation that can be installed quickly, and that has sufficient bearing surface to carry the load, the method given below is used in a busy terminal.

Construction of the Crossing

The general design of the crossing foundation is similar to the steel type developed some years ago, except that timber is used instead of structural shapes. Two 12-in. by 14-in. timbers are utilized under each rail of the track carrying the heavier traffic. These two timbers are bolted tightly together, making in effect one built-up beam 14 in. deep and 24 in. wide. Other sizes would answer just as well. For instance, three 8-in. by 16-in. timbers might be used, although this would require the removal of considerable old ballast, which is objectionable. The timbers should be at least as long as the crossing, including the exterior arms.

The timber foundation is assembled as close to the crossing as possible, each heavy-traffic track being handled as a unit. The distance between the built-up beams depends on the design of the castings. The beams are separated and stiffened by 12-in. by 12-in. cross struts, and are fastened together by 1-in. rods placed on each side of and close to the struts.

After the timber foundation is completed, the crossing frogs are placed on it, and bolted to each other and also to the foundation. The bolts are inserted in the spike holes in the castings or plates and extend through the timbers. The crossings are set up so that the track carrying the heavy traffic can be installed in one operation.

Installation

The old crossing frogs, including ties, are removed bodily by a crane, all old ballast and dirt are cleaned out to a depth of one inch below the bottom of the new timber foundation, and the new crossings are set in place. The removal of the ballast consumes at last 50 per cent of the time required for the actual installation, as the bottom of the new foundation timbers is usually about seven inches lower than the bottom of the ties in the old crossing. Care should be taken not to remove more of the bed of old ballast than is absolutely necessary, as it makes an excellent foundation for the new crossing timbers. Crushed stone is then used to raise the new crossing to the proper grade, being easily placed under the 24-in. bearing timbers by air tampers or picks. The spaces between the timbers and between the tracks may be left open. Ordinary crossties are used to support the connecting rails between crossings where there are two or more heavy-traffic tracks.

One advantage of this method is that the installation can be made with little interference to train operation on the line carrying the heavy traffic. Using a crane, the old crossing is lifted out and laid aside, and while the crane is getting the new crossing, the old ballast is cleaned out to the proper depth. When this is completed, the new crossing, together with the foundation, can be placed in one operation.

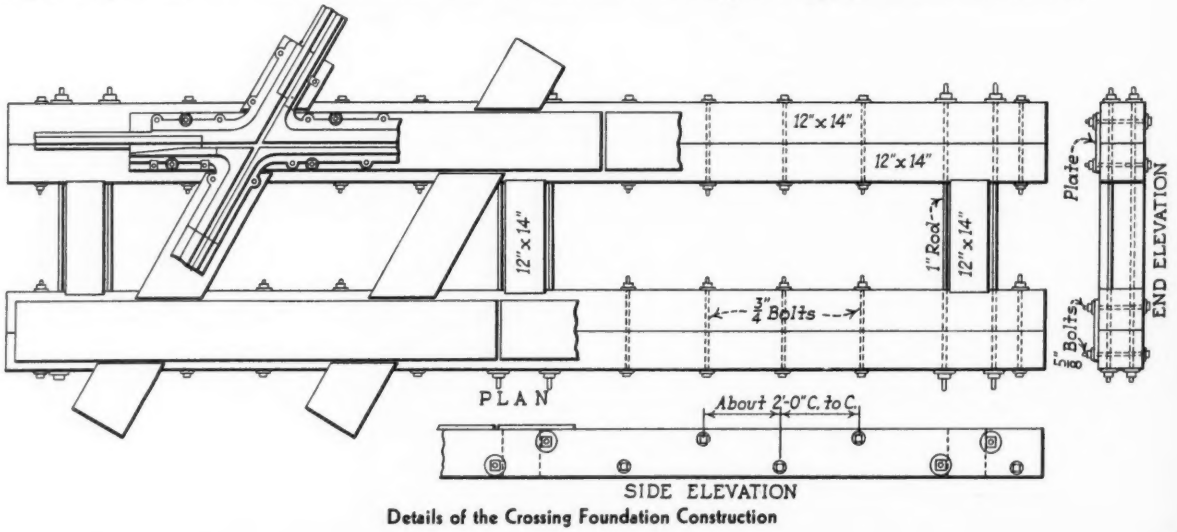
As soon as connections are made to the rails on each side of the crossing, traffic can be resumed, as it is seldom necessary to surface the crossing immediately, provided care has been taken not to remove too much of the old bed of ballast. If the new crossing is several inches too low it can be jacked up and blocks placed temporarily under the timber foundation. When ties are used under a crossing, it is essential that each tie be properly and uniformly tamped so that the load will be equally distributed and no undue stresses placed on any one portion of the crossing frogs, while with the built-up timber type of foundation, all parts of the frog castings have a uniform bearing, the beams acting as a bridge temporarily supported at two or more points.

Another advantage which arises in connection with the use of this type of foundation is that second-hand timber can be used, as it will usually outlast the crossing, whereas it would be poor policy to use second-hand cross or switch ties under a new crossing. In one case where crossings were renewed after two years' service, the old timbers were found in good shape and are being kept for future use. It is likely that they will give a total of six years' service.

On one job where two heavy-traffic main tracks and one side track crossed two street railway tracks, making six sets of frogs, the entire installation (excluding preliminary work) was made and all tracks restored to operation in seven hours. Service on the street railway was diverted while the work was under way but one of the main tracks was kept open continuously for single-line operation. On this job 45 sections (diamonds) of plank were constructed in advance and were therefore ready for placing when the crossings were installed.

The following objections to this method may be presented: The comparatively high cost of assembling the crossing foundation, as it is necessary that most of the work be done by carpenters; the large quantity of timber required as compared with ties, the ratio being approximately three to one on the basis of feet-board measure; the excess first cost of labor and material, which is probably 50 per cent more for the beam method than when ties are used; and the difficulty of securing timbers of suitable cross-section and length.

The advantages may be summarized as follows: The facility of installation, with consequent slight interruption to traffic; the longer life that is secured from timbers than from ties, which is probably about two to one in favor of the former; a certain amount of resiliency —a compromise between the usual flexibility of a tie foundation and one of absolute rigidity, such as would be secured by using concrete; and the uniform settlement of the crossing which rides fairly well even when low. To these may be added the following; fewer loose bolts, less surfacing, longer crossing life, especially in solid manganese types, and less maintenance.



Details of the Crossing Foundation Construction

WHAT'S THE ANSWER?

Have you a question you would like to have someone answer? Have you an answer to any of the questions listed here?

To Be Answered in November

1. *What precautions should be observed in the use of mauls and sledges to avoid injury to trackmen?*

2. *Where muddy water is being treated, should it be filtered before or after treatment?*

3. *When track is maintained to a uniform standard, on what part of the track does rail batter occur first? Does wide gage have any influence on its development?*

4. *Where short I-beam spans become too light for the loading, is it more economical to strengthen or to replace them? If the former, how should this be done? If the latter, what is the most satisfactory method?*

5. *What effect, if any, does "boxing" the ballast have on track conditions?*

6. *What methods, if any, can be employed to prevent or minimize the cutting of pipes leading from the sand drier to the storage at locomotive sanding stations when compressed air is employed to elevate the sand?*

7. *What causes ties to break at the ends? What can be done to prevent this?*

8. *What form of record should a bridge and building supervisor keep of the condition of the bridges and culverts on his territory?*

Curbs for Platforms

What are the relative advantages or disadvantages of wood and concrete curbs for cinder or screenings platforms at small stations? Should the wood be treated ?

Prefers Concrete Curbs

By A. T. HAWK

Engineer of Buildings, Chicago, Rock Island & Pacific, Chicago

Wood curbs are used quite frequently, since they can be installed quickly, particularly if the necessary material is already on hand. If the work is done well, however, there is relatively little difference in the first cost of wood curbing and a satisfactory concrete curb. This statement applies particularly to platforms that are approximately at track level, or at most 1 in. to 1½ in. above the rail. If the platform is higher, say 5 in. to 6 in. above the rail, the cost of the concrete curb will be greater.

In the construction of wood curbs, it is common practice to use second-hand bridge stringers or car sills. In either event, they should be properly anchored and the parallel longitudinal lines of curb, front and rear, should be rodded to prevent spreading. This precaution is particularly necessary where the curb is constructed of 3-in. planks. Where the plank is used, it should also be anchored vertically by means of posts, 5 ft. 4 in. long, spaced at intervals of 5 ft. 4 in. placed inside the curb, and having the top beveled so that no part of it will be exposed. The curb should be bolted to the posts. This length of post is required in the northern sections of the country where there is a decided tendency for this form of curb to heave during the winter. If wood is used, it should be creosoted, as decay will otherwise be rapid.

Concrete curbing, particularly if the platform is low, costs little, if any, more than a properly constructed wood curb. This type of curb is subject to the same frost action, however, but not in the same degree, as the wood curb. For this reason, if the footing is deep enough to prevent tipping, it is likely to be deep enough to resist heaving, particularly if the inner face is given the proper batter.

I am in favor of the concrete curb, because it has a long life and requires practically no maintenance, while a wood curb is always giving trouble. It has the further advantage that it is better looking, keeps its line well and permits the maintenance of a more satisfactory platform surface.

Depends on the Standard of Maintenance

By General Inspector of Buildings

On the basis of original expenditure, wood curbs constructed of second-hand creosoted bridge stringers will probably show an advantage over concrete curbs. If they are properly constructed, however, the margin is not so great as is usually assumed. This becomes less if new material is used. The reason for this is that labor constitutes the largest item in the cost of both types and there is little difference in the amount of labor required if both are placed with the same care.

Some of the concrete curbing which has been placed in the past has little to recommend it, since the work has frequently been done by inexperienced carpenter gangs, using low-grade aggregates, insufficient cement and a high water-cement ratio. In many cases I have seen, a wood curb would have been an improvement over the concrete curb as installed. This is not an argument against this type of construction, however, but rather against the lack of supervision which permitted such careless workmanship.

As I see it, the case for either type resolves itself into a question of the standard of maintenance on the individual roads. Some have rules which prohibit the use of wood curbs or cinder platforms, although they may permit screenings platforms at small and unimportant stations. Others, because they put no book value on second-hand material, justify the use of wood curbs by the fact that there is a difference in first cost in favor of this form of construction. It should be borne in mind, however, that a well constructed concrete curb has an indefinite life, requires no maintenance, and presents a neat appearance as long as it lasts. The wood curb, on the other hand, has a shorter life, requires considerable maintenance and never looks well.

Creosoted Timber Curb Is More Economical

By E. A. CRAFT
Engineer Maintenance of Way, Southern Pacific, Houston, Tex.

Concrete curb has the advantage of presenting a more pleasing appearance, while it should have a longer life. Wood curb has the advantage of smaller first cost, while some of the material can usually be salvaged in case the facility is retired. At present prices, creosoted timber can be installed for little more than half the cost of concrete curb, and for small stations serves the purpose just as well.

There are few, if any, places where concrete curb can be shown to be more economical on an annual cost basis when compared to creosoted timber curb. At small stations, if the drainage is good and the character of the material in the platform is not such as to aggravate corrosion, it is often satisfactory to fill the platform in to the rail and thus eliminate the use of any kind of curb.

Blocking of Culverts

What methods, if any, can be employed to prevent the blocking of culverts by storm-water deposits ?

Retarding the Flow Affords Relief

By G. STAFFORD
Section Foreman, Canadian National, Rosebud, Alta.

While not peculiar to any particular territory, clogged culverts are principally a problem of valley locations because of the quick runoff from the side hills. In country of more favorable topography from the standpoint of drainage, the usual cleaning and straightening of channels may suffice. In sections where the runoff must pass over steep slopes and reaches the railway in large volume and usually at relatively high velocity, special measures are necessary to afford permanent relief.

Since the velocity of flow is the controlling factor which determines the conditions that must be met, the solution of the problem is generally one of flood control. The most effective method is to terrace the channel bed of the stream for a considerable distance above the mouth of the culvert, sometimes for as much as half a mile or more, by means of a series of dams which tend to flatten out the grade and retard the flow. This plan also has the advantage that much of the suspended matter is deposited before it reaches the culvert.

A simple form of construction that can be undertaken by the section forces consists of old ties driven into the bed of the stream and strengthened by old fence wire and an interlacing of saplings. A small amount of backfilling should be placed both above and below each of the dams to serve as a support until natural accretion of the deposited matter occurs. Where greater stability is required, rock-filled timber cribs can be constructed of second-hand bridge timbers. In extreme cases concrete or stone masonry dams may be required.

Another simple and effective method, where the debris consists principally of lighter drift, such as twigs, leaves, straw, etc., is to string hog-tight fences across the channel at suitable intervals, to act as strainers. Care should be taken, however, to erect the last one a sufficient distance from the mouth of the culvert to insure that the normal velocity of the current through the culvert will not be impeded.

Willow plantings along the sides of the channel and across the bed are often quite effective in streams that are normally dry. These trees have a quick growth, are hardy and persistent, while the mass of roots which they develop tends to prevent scour. The branches are able, also, to withstand the effects of high velocity currents and catch and retain the heaviest forms of light drift and even heavy suspended matter.

From long experience in sections subject to adverse conditions of flood and deposit, I am of the opinion that no culvert in such territory should be installed with dimensions less than 2 ft. wide by 3 ft. high. Smaller openings clog very quickly and are extremely difficult to clean.

Channel Retards Are Most Effective

By Engineer Maintenance of Way

Ordinarily this is a problem which is met in its most aggravated form on railways that are located in the flat lands of the valley of a large stream, and which cross the tributaries of this stream a short distance from the point where they issue from the hills. As the water strikes the flatter land, its velocity is reduced and the suspended matter and rolling stones and gravel are deposited to build up the beds, these deposits eventually reaching the culverts. Under certain conditions, however, side-hill locations high above the valley floor may give fully as much trouble, particularly if the openings are not of ample size and proper design.

If, as sometimes occurs, the trouble is caused by lighter drift, such as brush, leaves or other vegetation, drift catchers, constructed of old rails set firmly in concrete, afford an effective means of stopping the load before it reaches the culvert. This scheme has the further advantage that, if the rails are properly spaced and well anchored, they will also act as ice breakers during the first spring floods. At a suitable time the drift should be opened up to dry out and then burned as soon as practicable.

Heavier materials, such as silt, sand, gravel and, frequently, large boulders, present an entirely different problem. The character, the size and the amount of these materials which are brought down depend on the volume of water, the grade of the channel, the steepness of the hills forming the watershed and the character of their formation. In general, some form of retard, such as a series of dams to form terraces, the planting of willows, or a combination of both will be most effective.

In my experience, I have encountered conditions where the grade below the culvert was such that it would accommodate the accumulation for several years. In such instances a straight, deep and narrow concrete flume with smooth sides and bottom, placed on a proper grade, will usually carry the load through the culvert with little or no deposit. When the lower channel becomes filled,

it can be cleaned out with a steam shovel, after which it is in shape for several more years. In fact, if the excavation is properly planned, the lower channel may be in better shape than it was originally.

The design of the culvert frequently has a decided influence on the amount of trouble experienced from stormwater deposits. If grade conditions permit, the floor should be a prolongation of the grade of the bed of the stream above the opening. In many instances, it can be made slightly greater with good results; it should never be flatter, as this is a sure method of starting a deposit at its upper end. The opening should also be as high and narrow as practicable. The horizontal dimension should not be so small, however, as to obstruct the flow or back up the water before it enters the opening. Neither should it be so wide as to broaden out the stream during its passage, but the grade and width should be so balanced as to increase the velocity of the water as it passes through.

Smoothing Track

During the tie-renewal season, how much time, if any, should be allotted to smoothing the track? Should this time be regularly assigned or left to the judgment of the local section forces ?

Smoothing Track Should Not Be Neglected

By B. E. HALEY
General Roadmaster, Atlantic Coast Line, Lakeland, Fla.

Under normal conditions there should be no difference in the amount of time assigned to smoothing up the track during the period of tie renewals than when other classes of work are being performed. If the renewals are heavy and the time for completing them is limited, some exception should be made, if in the judgment of the roadmaster this is necessary. There is nothing gained under ordinary conditions, however, in neglecting to keep the track smooth.

Where the renewals are substantially uniform, the work should be started at one end of the section and should progress continuously until completed. Foremen should be compelled to put the surface and line in first class condition as the work progresses, so that there will be little, if any, smoothing needed behind them. Sufficient time should always be allowed to keep the track ahead in good riding condition. When starting tie renewals, two days a week should be sufficient to do all the smoothing that is necessary. This can be varied to some extent as the renewals progress toward completion.

Definite assignment of the time for smoothing should be made by the supervisor; this should never be left to the judgment of the section foreman. Most foremen have sufficient judgment, but in their haste to complete their tie renewals, they seldom exercise it properly. In general, they do not like the work of smoothing track. It is slow and tedious and seldom makes much of a showing so far as progress is concerned. For this reason, it is advisable for the supervisor not only to allot the time but also to specify the days when the smoothing shall be done. As he is going over the road constantly and should be in daily touch with his foremen, this will add nothing to his work.

Keeping the track smooth should be a matter for preferred attention at all times. It should never be deferred to give priority to other classes of work. If the smoothing is done regularly, it will prove to be less expensive in the long run. Rough places never improve until they are given attention, while they are certain to extend themselves if neglected. Any neglect of this part of the work will eventually react unfavorably on the track condition and will entail a larger expense than if the work is done at the proper time.

No Set Rule Can Be Applied

By E. D. SWIFT
Engineer Maintenance of Way, Belt Railway of Chicago

Too many variables affect track conditions, including the kinds and importance of the traffic, the opportunities for doing work and the physical conditions of the different sections, to permit the application of any set rule for general use. The question seems to involve only one feature in the wide variety of affairs which are constantly changing in actual as well as relative value, and which make up the component parts of the maintenance program which must be planned and executed. Both tie renewals and smoothing track are in themselves important features of track maintenance, but neither, from a practical viewpoint, deserves priority over the other or over other requirements of maintenance. In my opinion, local conditions will govern in planning the time and sequence of events in a maintenance program.

Maintenance programs should be definite and detailed, but not so rigid that they cannot be modified to conform to changes in underlying conditions or to meet emergencies. The fact that maintenance is not itself the end, but the means to an end, should always be borne in mind. Furnishing transportation is the real business of the railways, and since track maintenance is but a means to that end, the aim should always be to adjust maintenance activities to the necessities of transportation—not alone in its larger aspects, but also in minor matters.

Should Be Left to Judgment of Foreman

By H. BECKER
Section Foreman, St. Louis - San Francisco, Rush Tower, Mo.

If the renewals are heavy, the track should be given a sufficient raise to eliminate the necessity of disturbing the old bed. If this can be done, only a minimum amount of smoothing is required. If the renewals are light and the ties must be dug in, the amount of time that must be given to smoothing is increased, no matter how carefully the track is lined and surfaced during the process. In either event, however, the matter of the time to be given to smoothing the track should be left to the foreman. He is well acquainted with his section and is over it every day, and, if he exercises good judgment, he can do his work to better advantage than if he is supervised too closely. Too much supervision is likely to get him into a frame of mind where he relies on his superior officer to the extent that he loses his own initiative.

Supervisor Should Allot Time

By W. H. SPARKS
General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

It should be the practice to assign a definite period to smoothing the track before undertaking tie renewals, every foreman being required to go over his entire section, picking up the surface and lining. If this is done thoroughly, it will minimize the amount of time and labor which must be applied to this feature of their work while the renewals are under way.

After the tie renewals are started, four days a week

should be allotted to this work. On Friday and Saturday the gang should go over the track, picking up and lining wherever needed and do such other general work as may be necessary, including the foreman's formal switch inspection. In some instances, depending on the age of the rail, the tie and ballast conditions, drainage, etc., more or less time for smoothing and general work may be necessary. This is a matter for local decision, however. In my opinion, the time allotment should be made by the supervisor, but only after a thorough discussion and understanding with the foreman. In general, the foreman knows his section better than any one else can, so that only a little coaching should be necessary to have him keep his track in good-riding condition at all times.

The Track Should Be Kept Smooth

By A. J. BOWERS
Supervisor, Wabash, Toledo, Ohio

During the tie renewal season, the track should be kept in smooth-riding condition, as it should at all other times. Sufficient time should be allotted to smoothing, but it is not necessary that it be regularly assigned. In general, this should be left to the judgment of the section foreman. He is held responsible for the safety and track conditions on his section, and if he is the right sort he takes great pride in keeping it to the highest practicable standard. He knows the physical characteristics of his track more intimately than any one else, and the amount of time that should be required to keep it in good shape. For this reason, he should be allowed a free hand, unless it is observed by the supervisor that he is not using good judgment, in which case the latter should step in and make the assignment.

Cutting the Right of Way

How should a section gang of six to eight men be organized for cutting the right of way? What incidental work, if any, should be done at this time ?

Organization Increases Output

By H. BECKER
Section Foreman, St. Louis-San Francisco, Rush Tower, Mo.

It is astonishing how much more a well-organized gang will mow than one that is not organized properly. It is my custom to divide my gang, putting half of them on either side of the track, placing the inside man so he will mow away from the track in order to keep the ballast clean. The remaining men should follow each other in order, but well separated to avoid injury. They are instructed to be extremely careful when mowing on rough ground, to avoid damaging their blades. Dull blades not only slow down the operation, but a good job of cutting is impossible without a keen sharp edge. A well-organized gang having a spirit of rivalry between the two groups will cover a surprising amount of ground in a day.

Depends on Width of Right of Way

By A. J. BOWERS
Supervisor, Wabash, Toledo, Ohio

The organization of a gang such as is assumed in the question will depend somewhat on the width of the right of way and the characteristics of the ground. Assuming that it is 100 ft. wide, the gang should be organized to cut one side at a time, the men being so assigned that everything will be completed, cutting weeds and brush and forming fire guards, as they go. They should always mow on the left hand side of the track in the direction they are mowing. The right of way should be cut between July 1 and July 15 in the states east of the Mississippi and north of the Ohio rivers. If done at this time, more weeds will be destroyed before the seeds are matured, than at any other period. Once started, the cutting should proceed without interruption until it is completed.

Keep Men Well Separated

By ROBERT WHITE
Section Foreman, Grand Trunk Western, Drayton Plains, Mich.

A gang of six to eight men should be divided, placing half of them on one side of the track and the remainder on the other. The scythe men should follow one another at intervals of 25 ft. or more as a safety precaution. This spacing also has the advantage that it eliminates much of the visiting and story telling which always seems to afflict a mowing gang. Usually, by placing the separate groups on opposite sides of the track a bit of friendly rivalry can be provoked and the work will be done quicker.

In many cases, I have found that time can be saved by first mowing and cutting fire guards around buildings and timber bridges, since the general operation of cutting does not then need to be interrupted after it is started. The men should not pass over or kick scrap out of the way, which they may find while mowing. It should be thrown on the shoulder of the roadbed where it can be picked up and taken in at the end of the day.

Efficiency Requires Organization

By A. H. REETZ
Supervisor, Minneapolis & St. Louis, Hampton, Iowa

No operation can be carried on efficiently unless it is organized, and the cutting of the right of way is no exception. It has been my observation that a gang of indifferent ability at mowing, if properly organized, will accomplish more work and do a better job of cutting than a poorly organized gang in which all of the men can use scythes well.

In organizing for this work, consideration must be given to each individual. A man who is exceptional at other work may be a total failure with a scythe and no amount of effort will train him to mow. If the gang consists of eight men, the six who can best use the scythes should be lined up one behind the other, each taking a swath. The mowing immediately creates a fire hazard as the vegetation dries out. The remaining two men should, therefore, cut with shovels a fire guard around trestles, wooden culverts, telegraph poles, signs and buildings. If the mowers encounter brush which they cannot cut with the scythes, these two men should cut it with hand axes. Normally, there is no reason why the foreman should not also join in this part of the work. Mowing is usually done in hot weather and the men must have plenty of water to drink. One of the duties of this group should be to see that it is provided.

Where teams are employed, the same plan can be followed, the scythe men doing the mowing on the rough ground, along fences and at other places inaccessible to the machine, while the shovel group, perhaps augmented by one or two from the larger group, cuts the brush and fire guards, since the mowing will be done faster.

An important feature of the preparations for mow-

ing is to have a reserve supply of scythe blades, so that the men will have sharp blades in the morning and again after lunch without losing the time necessary to grind them after the work is started. The grinding of the blades is always a problem since only two men are needed for grinding while the remainder stand idle during the process of sharpening. A reserve supply of blades solves this problem. The grinding should be done at the tool house at the end of the day when the men are tired. This enables them to get an early start the next day while they are still fresh.

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Wing Rails on Spring Frogs

What methods, if any, can be employed to keep the wing rails on spring frogs closed during hot weather ?

Attention to Detail Is Necessary

By A. J. BOWERS,
Supervisor, Wabash, Toledo, Ohio.

Wings rails on spring frogs can be kept closed during hot weather, if proper attention is given to the necessary details. All bolts and rivets should be kept tight. It is important that plates and all movable parts be well lubricated. The spring bolt should always be adjusted to maintain the proper tension in the spring. Expansion through the turnout and for a considerable distance either side should be watched carefully. Creeping rails tend to buckle the frog out of line as well as to distort the gage. In either event, it is not possible to maintain a good fit between the wing rail and the point, with the likelihood that the wing will stand open.

Use Plenty of Anti-Creepers

By ANDY SORENSON
Section Foreman, Northern Pacific

Keeping the wing rails of spring frogs to a proper fit and working freely during hot weather presents a problem that can be solved only by the use of sufficient anti-creepers to prevent the running rails from crowding against the frog. In addition, all bolts should be kept tight so that the frog will not be distorted by any pressure that may be brought against it by the expanding rails as the temperature increases.

As a rule this pressure is exerted against the tongue. For this reason, a shim placed between the fixed wing and the abutting turnout-rail will help to hold the frog.

Proper Expansion Is Important

By A. PADGETT,
Section Foreman, Missouri Pacific, Hargrave, Kan.

Proper expansion is of prime importance in keeping wing rails closed at any time, and this is particularly true during hot weather. A proper job of anchoring requires not less than six anti-creepers to the rail. One should be applied at each quarter and four at the center, placing them on opposite sides of the middle ties. They should be applied in the same manner to the running rails through the turnout, and on every third tie on the turnout rails to prevent any movement of these rails toward the switch points. If the outer turnout rail is allowed to move toward the switch point, it pulls the wing rail with it and causes it to stand open.

All switch ties should be in first class condition, this being particularly important under the frog. Spikes should set snugly against the rail and be kept down. All bolts in the rail joints and frog should be tight, and the wing rails should be well lubricated to allow free movement over the plate.

Avoid Creeping Rails

By A. W. WEHNER,
Roadmaster, Southern Pacific, Lake Charles, La.

This trouble is usually experienced with frogs that are not equipped with anchor blocks. The movable wing on spring frogs can be kept working freely by providing the necessary expansion and then using sufficient anti-creepers to check the creeping of the rail. If anti-creepers are not available, all joints through and approaching the turnout should be slot spiked and the spikes kept down. My experience is that some adjustment should be made in the expansion as hot weather approaches. If this is done and the housing and slide plates are well lubricated, with proper tension on the spring, no trouble should be experienced in keeping the wings closed.

Precautions Begin with Installation

By W. H. SPARKS,
General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

To be most effective, any method designed to overcome this form of trouble should begin with the installation of the switch and should be continuous as long as the latter is in service. The ties under the frog should be adzed to a perfectly level plane. The running rail should be carefully lined through the length of the switch, so that when the frog and lead rails are set in the track and gaged, the frog will be in true line. Before the frog is spiked to gage, however, the outside turnout rail should be adjusted so that the wing rail fits properly against the frog point.

If the ties are level and are kept tamped to a full bearing against the frog plate, the gage is correct, a full complement of spikes has been driven properly in the frog plate, the wing rail fits against the point, the wing-rail bolts are correctly adjusted and the plates are well oiled, there should be no reason for the wing rails standing open at any time. Many of our troubles are due to the neglect of some or all of these points.

Where the main-track rails show a tendency to run, additional precautions are necessary. This trouble can be overcome, however, by the use of anti-creepers and by the application of heel blocks at the switch points and similar castings at the heel and toe of the frog.

Poor Maintenance Is Principal Trouble

By R. ROSSI,
Yard Foreman, Alton, Chicago

Among the causes of open wing rails are lack of proper expansion, creeping rails, the use of filler bolts that pass through the running rail at the heel of the frog, wide gage at the toe of the frog, loose frog bolts, broken springs and the lack of lubrication. Every one of these is the result of poor maintenance.

To insure that the wing rail will stay closed, the gage at the point should be ¼ in. wide, while at the heel and toe it should be standard. The spring should be properly adjusted for tension. The frog should be kept free of dirt and other foreign matter. The ballast should be about 2½ in. below the top of the ties. Ample lubri-

cation should be applied. Sufficient anti-creepers should be in service to prevent rail creepage. The ties under the frog should be tamped to a solid bearing, and the frog plate should be kept level or in the plane of the track, if the turnout is on a curve. A heel casting should be used, but the bolts should not pass through the running rail.

Keep the Frog from Being Distorted

By H. BECKER,

Section Foreman, St. Louis-San Francisco, Rush Tower, Mo.

Assuming that the frog is being maintained properly in all other respects, the only reason why the wing rail stands open in hot weather, or at any other time for that matter, is that the main track rail runs or expands enough to crowd either the wing rail or the entire frog out of position. In the latter case, it is quite certain that the frog will also become somewhat distorted.

To prevent this I have found it advantageous to apply a channel plate at the toe of the frog, which is bolted to both the fixed and moving wings. This device holds these wings in a fixed relation to each other and to the remainder of the frog, and overcomes the tendency of the wing rail to run. Otherwise, it is possible that not only will the wing stand open, but it may move longitudinally a sufficient amount to shear the spring bolt. If this happens, a dangerous condition is set up which may result in a derailment.

Pumping Coffer Dams

What type of pump can be used to best advantage for keeping coffer dams dry where the inflow is moderate ?

Portable Centrifugal Pumps Are Best

By General Inspector of Bridges

We find that the most useful general-service equipment for all conditions is a portable centrifugal pump of 2-in. or 2½-in. suction. It is our practice to construct and repair with company forces all but the largest jobs of foundation work. Our own forces are, therefore, constantly engaged in the construction and repair of piers, abutments, box culverts and other similar structures. In addition to the jobs handled by the system bridge organization, the division forces usually place the smaller box culverts, all pipe culverts and headwalls. In our territory, pumps of greater capacity than those mentioned are seldom required or, if they are, a duplication of the equipment is generally sufficient.

Because we find them economical, easy to handle and effective for the work for which they are intended, all of our system gangs are equipped with pumps of this type. In addition to these gangs, most of our division forces have two similar pumps assigned to them. They use them in building work as well as for bridge foundations and culverts. I have often seen them installed to provide water for boilers and concrete mixers on other jobs, while the water service forces often borrow them to facilitate their work.

A job recently came to my attention where a pier foundation was sunk through a clay stratum, in which two of these pumps were used to make all of the excavation. The clay was not water-bearing but was easily eroded. One of the pumps, equipped with a nozzle, eroded the material and kept it stirred up so that it remained in suspension, while the other pumped the muddy water out of the coffer dam. Since plenty of water was available, the cost of making the excavation by this method was only a fraction of what it would have been if ordinary methods had been employed.

Many Conditions Influence the Selection

By Engineer of Bridges

Many conditions other than the rate of inflow influence the selection of the pumping equipment for coffer dams. If the excavation is being made through a formation of such character that the water is reasonably clear and is free from grit, a small steam-driven plunger pump may be as satisfactory as any other type. This type of pump possesses the advantage that it can be operated at varying speeds and, therefore, run continuously to keep abreast of the inflow. Again, if proper care is exercised, no priming is necessary if it is shut down at any time.

Such favorable conditions are seldom encountered, so that it is usually necessary to select a type of pump that will be least affected by the suspended matter in the water. There are several makes of pumps on the market which are designed for this service, which will readily handle without unreasonable wear, muddy water or water containing considerable sand and grit and even moderate sized pebbles. Most of these pumps are of larger capacity, however, than is necessary for the conditions assumed in the question.

For these reasons, a small-capacity portable centrifugal pump, having a 2-in. or 2½-in. suction, designed for rough service will ordinarily give the best results. Pumps of this type are relatively light, so that they can be handled with facility, while, because of their small size, they do not interfere with the other operations in the coffer dam.

Repairing Leaks in Pipes

What methods can be employed to repair leaks in underground water lines ?

Depends Largely on Character of Leak

By C. R. KNOWLES

Superintendent Water Service, Illinois Central, Chicago

Causes of leaks in underground mains are so varied that no set rule can be established for their repair. Nearly every leak occurring in an underground main calls for emergency repairs and the manner of making them depends on the nature of the leak and the facilities available. Most underground leaks are in the joints of cast iron bell and spigot pipe, because a preponderance of the joints in underground pipe lines are of this type. The necessary tools for making repairs to lead joints are usually readily available, since repairs to leaks of this kind are a part of the routine work of the water works repairman.

A leak which results from a hole in the pipe or from a split or cracked pipe is more difficult to handle. With the smaller sizes of pipe, say up to four inches, the simplest method of repairing the leak is to replace the defective pipe. On larger diameter lines, however, repairs require more time. The required material is not always readily available and it is not always convenient to take the line out of service for sufficient time to make

permanent repairs. It is usually necessary, therefore, to make emergency repairs pending the removal of the defective pipe or the opportunity to make permanent repairs.

The simplest method of making temporary repairs to a cracked pipe or to a large hole in the pipe is by means of clamps, using gaskets of either lead, rubber or leather, long splits in the pipe requiring the use of several clamps. If an iron clamp is not available, wooden clamps may sometimes be used effectively. Small pits or holes in the pipe may often be repaired by tapping out and plugging the hole with an ordinary pipe plug or, temporarily, they may be plugged with a piece of soft wood. Where cast iron pipe is broken in two, which sometimes occurs as a result of excessive vibration or settling foundations, repairs may be made by placing a sleeve over the pipe and calking each end with lead. The same method is sometimes followed in repairing long splits in pipe, using a piece of pipe larger than the broken pipe for a sleeve. Repairs to lead joints in pipe may be made by using lead wool which avoids the necessity for heating and pouring a new lead joint.

Wherever possible, permanent repairs should be made at once; in many cases where temporary repairs are made it is necessary to go over the same leak time after time, while permanent repairs can often be made at a cost only a little more than that of temporary repairs.

Pipe with lead joints laid under railroad tracks is frequently subject to leakage due to the vibration of passing trains. This can often be overcome and much time and labor saved by supporting the tracks so that the jar or vibration of passing trains does not come directly on the pipe. The methods to be followed vary and may consist of placing the surface pipe within a larger pipe or concrete box or by supporting the track on sills laid parallel with the pipe. Where pipe lines are laid in soft marshy ground, it may be necessary to provide a trestle over the pipe similar to a ballast deck trestle in order to minimize the repairs, although it is rarely necessary to incur this expense except with very large lines.

Leaks Fall in Three Major Classes

By L. L. TALLYN,
Division Engineer, Delaware, Lackawanna & Western, Scranton, Pa.

Normally, cast-iron pipe lines afford the most difficult problems with respect to repairing leaks in underground lines. Such leaks are usually the result of one of the following conditions, while the method of making the repairs is indicated by the major classifications they fall into:

1. Failure of a calked joint. If the lead has moved out of the joint slightly, the leak can usually be stopped by recalking. If there is a bad spot which is the result of improperly pouring the lead in the first instance, the leak can usually be stopped by filling the hole with lead wool and calking. If the lead has been blown out of the joint, repouring will be necessary. For this purpose, the use of one of the patent jointing compounds which are available, has been found to be most satisfactory, from the standpoints of both safety and practicability. The reason for this is that these materials do not require calking and the joint can be poured in the presence of water without causing an explosion.

2. Cracked pipe. In this case, either of two methods can be employed. First, the length of damaged pipe may be removed and replaced with two shorter sections of sound pipe. In this method, a solid sleeve is slipped over the abutting ends of the short sections and lead or leadite joints are applied. Second, depending upon the condition of the pipe and the extent of the crack, the leak can be stopped by resort to bronze welding.

3. Square breaks. In this case, the use of a split sleeve gives the most satisfactory results, as it is easily applied and eliminates the necessity of removing the broken section. It is sometimes practicable, under favorable conditions, to make repairs by bronze welding.

Relief Valves Reduce Water Hammer

By R. J. SOUTHCOTT,
Water Service Foreman, Canadian National, Toronto, Ont.

If the trouble is in the joints of bell and spigot pipe, the best solution is to rerun the joints. I recently had considerable trouble in some lines that served water columns, in several discharge lines and in a city water main from which we received one of our supplies. Investigation developed that some of the joints in question were poorly made and that all of these lines were subject to some degree of water hammer.

Our first care was to eliminate or minimize, so far as practicable, the water hammer. In the service lines, the trouble resulted largely from the use of water columns of an early design. We reduced as much as possible of the lost motion in the working parts and installed extra relief valves.

With an oxy-acetylene torch, we melted out the faulty joints and repacked them with yarn. A few drops of oil were applied to counteract moisture, and the joints were repoured. These precautions were sufficient to eliminate the trouble. In another case, we found it necessary, however, to change the location of a 10-in. pipe line which crossed under a track at a frequently-used switch, as leaks developed constantly until it was placed clear of the track.

Renewing Pile Trestles

When driving new bents in an offset position for renewing a pile trestle, is it advisable to shorten the end panels to avoid driving new bents behind the old bulkheads ?

Shortening Is Desirable, if Practicable

By A. B. SCOWDEN
General Bridge Inspector, Baltimore & Ohio, Cincinnati, Ohio

Different problems are presented by every trestle, with reference to both the central portion and the end construction. The decision as to the details of construction must be made, therefore, on the basis of the local conditions. Certain general principles which apply to all cases, should be given prior consideration, however.

1. It is always advisable to shorten a trestle as much as the waterway and other conditions make practicable, in order to reduce the replacement cost and future maintenance expense.

2. High crib, or bulkhead, walls for retaining the embankment should be avoided, since they are expensive and difficult to maintain. The ideal bulkhead is only 3 to 4 ft. high and consists of a single thickness of treated timber or concrete plank.

3. The new pile bents, spaced in accordance with the standard plan, should be so located as to clear the old bents to facilitate driving. On older lines where there are piles from previous replacements, these must be located so as to select the most favorable position, and the bents staked out. Then, retaining the standard spacing for all intermediate bents, the end spans may be

shortened if conditions necessitate or permit this to be done.

It is not difficult to drive a pile bent behind an existing bulkhead, if found desirable. It is often satisfactory to drive it in front of the existing end bent, however, particularly where waste material is available for extending the embankment. While not always applicable, a general rule which is adapted for most conditions is to locate the new end bent back of the existing bulkhead where high cribwalls were used previously, but in front of it where the embankment can be extended easily without interfering with the purpose for which the opening was provided.

Depends on Opening Required

By L. G. BYRD

Bridge and Building Supervisor, Missouri Pacific, Wynne, Ark.

How the bents shall be located depends somewhat on the waterway or other requirements of the opening. If the opening is greater than is necessary, the new bents should be driven inside the old dump bents to avoid lengthening the bridge. Where all of the area is necessary, it is often possible to drive one new end bent behind one bulkhead and the one at the other end in front, choosing for the first the end where the embankment is weakest. The intermediate panels should always conform to the standard spacing.

Owing to the great increase in the weight of locomotives and cars during the last decade, many roads have progressively decreased their panel lengths till they are now as short as 12 ft. In such cases, it is my practice to lay out the bridge, beginning at the end where the old bulkhead is highest, and drive the first bent behind this bulkhead. The driving is done progressively, spacing all bents accurately on 12-ft. centers. Unless there are definite reasons for shortening the structure, the new one is made substantially of the same length as the old one. This may bring the final end bent to a position 3 or 4 ft. in front of the old end bent at this end of the bridge. Notes are made of the number of panels as the bridge is laid out and the entire deck is preframed, including caps, stringers, ties and guard timbers.

Where conditions permit, it is economical to drive the end bents inside the old bents at each end of the bridge, since the cost of filling is generally less than the cost of the extra length of the trestle, while a corresponding amount of maintenance is eliminated.

I have renewed about 300 panels, or 3,600 ft., of trestle during the last two years, and have preframed 75 per cent of the material before the piles were driven. The preframed material corresponded with the calculated lengths of these structures, while the bolt holes fit perfectly throughout. The end panels of all these bridges were of standard length.

Buckling Track

A further answer to the following question which was discussed in the August issue:

What precautions should be taken to prevent track buckling when surfacing during hot weather ?

Several Precautions May Be Taken

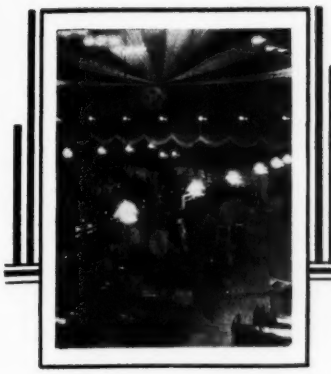
By W. E. CONNELL,

Roadmaster, Panhandle & Santa Fe, Pampa, Tex.

When surfacing during hot weather, the jacks should be set level and directly opposite each other. Care should be exercised to insure that both sides of the track are brought to the same elevation and at the same rate. The lifting should be moderately slow, and with even strokes. Jackmen should not be permitted to make quick or jerky strokes.

It is an excellent plan to check the track for some distance in both directions from where the surfacing is to be done. If there are any expansion gaps at the rail ends, the bolts should be loosened enough to insure that advantage will be obtained to the extent of the amount of these openings. If the rail is very tight, the track should not be raised until enough expansion has been obtained by one of the several methods by which this can be done. So far as possible, the track should be kept filled in immediately behind the tamping. This will minimize the tendency to buckle and will often eliminate the kinky condition of the track which so often occurs at this time, and will reduce the amount of lining.

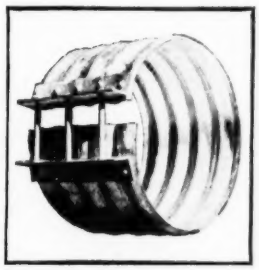
On the Swiss Federal Railways



NEW AND IMPROVED DEVICES

Connecting Bands for Armco Pipe

THE Armco Culvert Manufacturers Association, Middletown, Ohio, is now offering an improved design of connecting band for joining sections of Armco pipe. This band, which is known as the One-man Foolproof Band, is made in two types or sizes, one 7 in. wide, for small and medium size pipe and the other 12 in. wide for moderate and large size pipe.



The 12-in. Band

The collar is fastened on the pipe by means of angles which are drawn together by ½-in. bolts, there being three bolts to each 12-in. band and two to each 7-in. collar. Through the use of extra long bolts having specially designed heads for spreading the ends of the collars apart during installation, this operation may be accomplished by one man. Two of these long bolts are required for the 7-in. collar while one is sufficient for the 12-in. band. During the tightening of the bolts, they are prevented from turning by slots in the angles, thus allowing this operation to be accomplished by the use of only one wrench.

Develops New Air Wrench

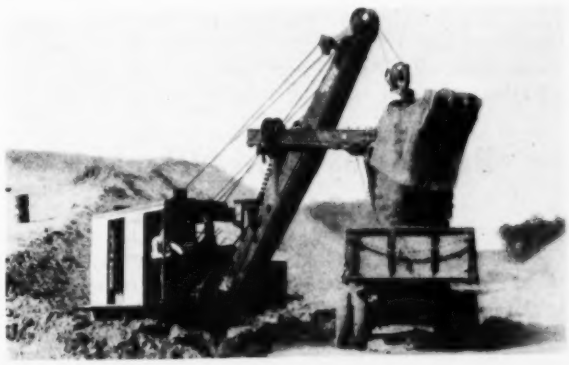
THE Chicago Pneumatic Tool Company, New York, has brought out a rotary pneumatic wrench for tightening and removing nuts on bolts up to and including 1¼ in. in size. This device, which is known as the CP No. 335-130, has a light speed of 130 r.p.m., an overall length of 7 7/32 in. and a weight of 48 lb. The sockets used with the wrench are a snap fit on the spindle and for this reason are said to insure quick and easy replacement when a different size of socket or the reverse motion is desired.

The New CP No. 335-130 Rotary Pneumatic Wrench

In the maintenance of way field, this wrench is applicable to the bolting of girders in bridge work, to the tightening of track bolts and to other bolt tightening operations. In track work, the wrench is supplied with compressed air from a portable compressor which also may be in use at the time for operating other pneumatic track tools. When used on maintenance work in yards, it is said that the wrench may be supplied with compressed air from yard air lines.

A New One-Yard Machine

A NEW one-cubic yard machine, known as the 32-B and convertible to a shovel, dragline, crane, or clamshell, has recently been developed by the Bucyrus-Erie Company, South Milwaukee, Wis. Special attention has been given to the balancing of the various motions of hoisting, crowding, swinging and dumping so that the complete cycle may be accomplished in a minimum of time. Other operating features claimed for this machine are stability, accessibility, quick convertibility and the efficient transmission of power to give the maximum digging force at the dipper teeth.



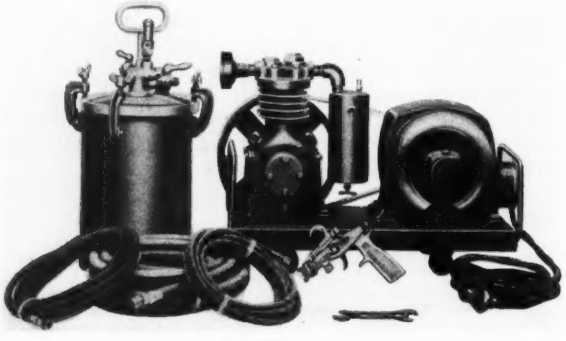
The New 32-B Bucyrus-Erie Machine

The machine may be operated by either gasoline, Diesel or electric power, and either a rope or a chain crowd on the shovel is available. Special extra long and wide mountings are also supplied for dragline work in soft ground. The engine transmission gears are fully enclosed and run in oil, as do the boom hoist worm and gear and the reversing transmission gears for swinging and propelling. All continuously running shafts are mounted on ball bearings to reduce friction, and only two bearings to a shaft are provided in order to eliminate binding under the stresses imposed in service.

The transmission gears are equipped with generated teeth, machine cut from solid steel. An outside hand power-take-off cluth and positive power dipper trip are also provided. The machine has a box girder boom and outside handles, single-shaft drive caterpillar mountings and an inserted tooth dipper.

A One-Man Spray-Painting Outfit

A SPRAY-PAINTING outfit, designed to be operated by one man, has recently been placed on the market by the DeVilbiss Company, Toledo, Ohio. This outfit, which is known as the DeVilbiss NK-606, is electrically operated and is of light and durable construction. It is said that the outfit is transported readily from place



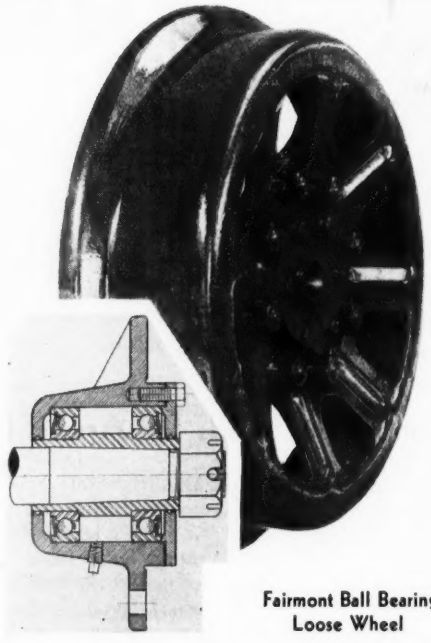
The DeVilbiss NK-606 Spray-Painting Outfit

to place and that it is easily carried by one man. The equipment consists of a ½-hp. electric-motor-driven compressing unit mounted on a castor base, one pressure-feed spray gun, one 2-gal. pressure feed paint tank, one 20-ft. length of 5/16-in. air hose and connections, one 12-ft. length of ¼-in. braid-covered hose and connections, and one 12-ft. length of 5/16-in. fluid hose and connections. This equipment may also be used as an effective means of spraying insecticides, germicides, etc.

Ball-Bearing Loose Wheel for Motor Cars and Trailers

A BALL-BEARING loose wheel, which is designed to promote safety in the operation of motor cars and trailers, has recently been developed by Fairmont Railway Motors, Inc., Fairmont, Minn. It is said that this wheel is permanently safe on curves and frogs and that it always runs true with no "play," wobbling, or side flopping. Other advantages claimed for this type of wheel include the folowing: Quick and easy removal of the motor car from the track; a saving in maintenance costs owing to the elimination of the cost of replacement parts and a reduction in the motor car maintainers time; elimination of the "human factor" which is occasionally manifested in the tendency to fail to remove some wheels when excessive wear causes wobbling, which sometimes leads to derailments.

Moreover, it is reported that the demountable hub in which the ball bearings are mounted will outwear many sets of wheels, as a new tire can be bolted on whenever the previous one becomes too thin. It is also said that the new tire costs less than an ordinary riveted type wheel. This hub fits any 1½-in. Fairmont standard taper turned axle, and all Fairmont demountable tires,



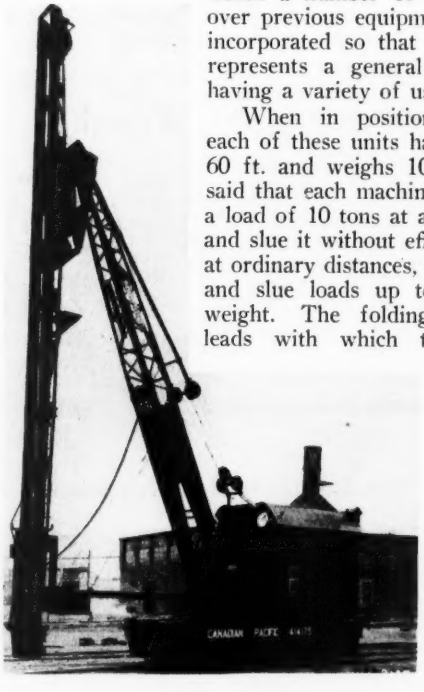
Fairmont Ball Bearing Loose Wheel

either 16 in. or 20 in. In the application of the hub or wheel, it is drawn snugly on the axle with any standard end nut in a manner similar to that used when applying an ordinary tight wheel. The hub carries a reserve supply of grease that requires checking only once in from two to six months, depending on the mileage traveled.

Combination Crane and Pile Driver Developed for C. P. R.

THE Browning Crane Company, Cleveland, Ohio, has recently delivered three combination steam locomotive cranes and pile drivers to the Canadian Pacific, in which a number of improvements over previous equipment have been incorporated so that each machine represents a general utility crane having a variety of uses.

When in position for action, each of these units has a height of 60 ft. and weighs 100 tons. It is said that each machine can pick up a load of 10 tons at a 40-ft. radius and slue it without effort, and that, at ordinary distances, it can pick up and slue loads up to 40 tons in weight. The folding pile driver leads with which the crane is



The New Browning Combination Locomotive Crane and Pile Driver

equipped, are fitted with a 6,700-lb. steam hammer capable of striking a blow of 8,200 ft. lb. and of driving large diameter piles up to about 30 ft. in length.

These cranes can travel at a speed of 15 miles an hour and can draw several loaded freight cars at about half this speed. A number of the improvements that are incorporated in the cranes were developed by the motive power and rolling stock department of the C.P.R. These include a special lubricating system, a disengaging mechanism for the travel gears, provision for heating the tender during cold weather, and a special boiler 72 in. in diameter for assuring a sufficiency of steam for all operations. In addition, the cranes are equipped with a generator for supplying current to the electric lights, and provision is also made for the use of an extra generator to permit the employment of an electro-magnet for handling scrap and steel supplies. Flood lights for night operation are also provided.

In addition to serving as cranes and pile drivers, these machines are equipped to handle dragline scraper buckets, snow buckets, and clam shell buckets up to two cubic yards in capacity.

This Truck Crane Operates on both Tracks and Pavements

A TRUCK crane that is equally adapted to service on a highway or a track, has been placed on the market by the Speeder Machinery Corporation, Cedar Rapids, Iowa. The crane is mounted on an O'Connell motor truck which derives its flexibility in service from an ingenious wheel arrangement, the flanged wheels of standard gage being provided on their outer sides with

The Chore Boy with a Clamshell

tapered drums upon which cast steel rims bearing solid rubber tires may be quickly attached or removed. No jacks are necessary for this change as the truck is run onto the track at a paved crossing and, when lined up with the track and run off the end of the crossing with the flanged wheels on the rails, the rubber tires will clear the ties and can then be easily removed. The two halves of the rear axles, which are full floating for road use, are arranged to lock so that the differential is ineffective when used on rails. At such times also, the steering gear is locked. The flanged tires are insulated from the wheel centers by a layer of Moran packing.

The arrangement of the power plant follows general practice except as to the transmission, which provides nine speeds effective in either direction through the agency of an independent reversing lever. The speeds available vary from the extreme slow movement necessary to start a loaded freight car to a maximum free-running speed of 35 m.p.h. on rails and 40 m.p.h. on pavement. The controls are located between two facing seats on the left side of the truck so that the driver can sit facing forward for movement in either direction, the clutch pedal for one direction serving as the brake pedal for the opposite direction and vice versa. The en-

The Chore Boy on the Rails

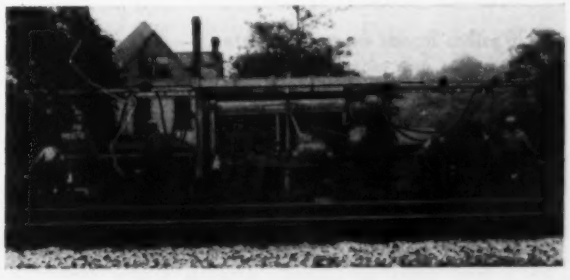
gine is a six-cylinder Buda DW6 of 73 hp. Each end of the truck is equipped with a buffer that is provided with tension and compression springs and on which is mounted a hook that will engage a standard automatic coupler.

On the rear half of the truck is a self-contained full revolving crane equipped with its own power plant, a 41-hp. Hercules gasoline engine. It has a double drum to accommodate the fall line and the dumping line of a clamshell bucket or the hauling line of a dragline bucket. In addition, there is a small separate drum for the boom line which is operated by a worm gear to insure against dropping the boom. Among features of the hoisting equipment are gears operating in an oil bath, double-band clutches, and a two-speed transmission affording greater power for heavy work and higher speeds for light work. The cab is of steel and has 75-in. tail-swing radius. The engine is equipped with an electric starter.

Booms may be had in lengths up to 35 ft. The capacity of the crane is 5 tons at a 10 ft. radius but it is said that when the rail clamps are applied, loads up to 8½ tons have been handled safely.

Provision has been made for the mounting of an electric generator under the truck frame where it can be driven from the transmission of the truck motor, and thus provide current for a lifting magnet.

This truck is known as the "Chore Boy" and, as its name indicates, is intended for general or varied service such as handling material with a hook, magnet or bucket, and excavating with a clamshell or dragline bucket. Owing to its ability to operate both on rails and highways, it can be used without interference with traffic and at the same time, can reach locations not accessible to highway vehicles. The weight of the "Chore Boy" in working order is 12 tons.



Modern Equipment for Pulling Track Spikes

NEWS OF THE MONTH

Freight Cars and Locomotives

In the first six months of 1931, the Class I railroads of the United States placed 6,951 new freight cars in service, as compared with 49,208 cars in the same period last year and 32,794 in the first half of 1929. These roads also placed in service 89 new locomotives in the first six months of this year as compared with 411 last year and 319 in 1929. On July 1 they had 8,963 new freight cars on order as against 24,649 on the same day last year, while locomotives on order on that date totaled 36 as compared with 364 last year.

New Record for Freight Delivery

Railroads operating out of Chicago established a new high record for on-time freight delivery during June, when 97.94 per cent of the l. c. l. shipments out of Chicago arrived at their destinations on time. The previous record of 97.68 per cent was established in May of this year. In June, 1930, 95.90 per cent of the cars were on time.

Court Upholds Order Limiting Truck Sizes in Idaho

The action of the Public Utilities Commission of the State of Idaho in limiting the dimensions of common carrier motor trucks operating on a certain section of United States Highway No. 10 in that state was upheld by the state Supreme court when that body was petitioned by the truck lines to have the commission's order set aside. Limitation of the size of trucks on this particular section was done as a safety measure, since the highway is narrow and winding and contains many "blind curves."

Western Roads Carry Rate Case to Supreme Court

The fight of the Western railroads to have set aside the recent order of the Interstate Commerce Commission prescribing lower rates on grain and grain products, has now been taken to the United States Supreme Court at Washington. On August 8 these roads filed in the court an appeal from the decision of the federal court at Chicago denying their application for an injunction to restrain the commission from putting the lower rates into effect. The rates went into effect on August 1.

Canal Business Increases

The New York State Barge Canal, for the 1931 period ending July 25, reported an increase in traffic of 15,926 tons, or one per cent, as compared with the corresponding period of 1930. During 1930 this canal handled 3,605,457 tons, as compared with 2,876,160 tons handled in 1929.

Pennsylvania Makes Progress in Safety Work

In the first six months of this year the Pennsylvania had a safety record of 4.3 injuries per million man-hours worked, which was the best six-months' record ever achieved by this road, according to R. V. Massey, vice-president in charge of personnel. As compared with 1930, this was a reduction of nearly 33 per cent. The accident rate on the Western region for the month of July was 1.8, the lowest record ever made on this region. Five of the nine divisions on this region went through this 31-day period without a reportable injury.

Freight Traffic Figures

Freight traffic handled by the Class I railroads in the first six months of 1931 amounted to 174,328,623,000 net ton-miles, a reduction of 37,916,444,000 net ton-miles, or 17.9 per cent, under that of the corresponding period of 1930, according to reports compiled by the Bureau of Railway Economics. The figure for the first half of this year also represents a reduction of 26.9 per cent under that for the comparable period of 1929. For the month of June freight traffic amounted to 28,257,921,000 net ton-miles, a reduction of 6,159,528,000 net ton-miles, or 17.9 per cent, under June, 1930. It was also a reduction of 30.6 per cent under June, 1929.

Pullman Company to Try Lower Rates for Upper Berths

A reduction of 37½ per cent in the rates for upper berths in Pullman cars is to be placed in effect on certain lines between August 20 and November 20, as an experiment to determine if a reduction in these rates will increase the use of this type of Pullman accommodation. The lower rates will be placed in effect between New York and Washington, D. C., on the Pennsylvania and on the Baltimore & Ohio—Reading—Central of New Jersey, and between Chicago and the Twin Cities on all roads operating between these points. At the reduced rates, the cost of an upper berth will be one-half that of a lower

More Roads Lower Rates to Meet Competition

The increasing severity of truck and barge competition continues to force the railroads to lower their rates on various commodities. The Norfolk Southern has been authorized by the Interstate Commerce Commission to reduce its rates on leaf tobacco from North and South Carolina points to Norfolk, Va., and Newport News, from 36 to 27 cents a 100 lb. to meet this competition. Other Southern roads have asked the commission for authority to make similar reductions between other points. The Interstate Commerce Commission has decided also not to suspend tariffs filed by the western trunk line and Illinois Freight Association lines establishing greatly reduced rates on refined petroleum, gasoline, kerosene and furnace oil distillate for short hauls in Illinois territory to meet motor truck competition.

State Supreme Court Ruling Favors Railroad

A railroad should be given preference over an independent motor coach company in the establishment of motor coach service along the lines of the railroad, where such service is in the public interest, according to a recent decision of the Ohio Supreme Court. The case involved a decision of the Public Utilities Commission of Ohio, which granted a certificate of convenience and necessity for the operation of a motor coach line along the line of the Pennsylvania across the State of Ohio to the White Star Bus Line, an independent organization, instead of to the Pennsylvania General Transit Company, a subsidiary of the Pennsylvania. Both companies had applied for permission to operate the line. The commission refused the request of the Pennsylvania for a rehearing of the case, whereupon it was carried to the state supreme court. In reversing the order of the commission, the court stated that in such cases no hard and fast rule

could be developed but that the road should be accorded the privilege of protecting its revenues.

Salary Reductions

At least nine railroads of the United States and Canada have reduced the salaries or wages of certain classes of their employees in the last few months. In most cases the reductions amount to about 10 per cent and affect only those officers or employees receiving salaries that are above a certain minimum. In some instances it is stated that the salary reductions have been applied as a temporary measure and that the full rates of pay will be restored with the return of normal business. Those roads that have effected salary reductions include the Pennsylvania, the Missouri Pacific, the Delaware & Hudson, the Missouri-Kansas-Texas, the Southern, the St. Louis-San Francisco, the Chicago & North Western, the Cincinnati & Lake Erie, and the Canadian National.

Railway Return Remains at Low Level

For the first six months of 1931 the Class I railroads of the United States had a net railway operating income of $238,550,140, which was at the annual rate of return of 2.15 per cent on their property investment, as compared with a net income of $377,379,211, or 3.46 per cent in the comparable period of 1930. Gross operating revenue for the first half of the year totaled $2,187,437,435, as compared with $2,692,255,942 for the same period in 1930, a decrease of 18.8 per cent. Operating expenses amounted to $1,716,774,190, as against $2,073,948,402, a decrease of 17.2 per cent. Taxes paid by the Class I railroads in the first six months of this year totaled $164,738,625, compared with $180,738,625 for the same period last year, a decrease of 8.6 per cent. Out of a total of about 180 Class I carriers, 41 operated at a loss in the first six months of 1931.

Boardman Becomes Dudley Professor of Railroad Engineering

Howard E. Boardman, construction engineer of the Boston & Maine since 1924, has been appointed Dudley Professor of Railroad Engineering at Yale University. This professorship was created by an endowment fund established by the late Lucy B. Dudley, and by an additional bequest of her husband, the late Dr. P. B. Dudley, who for many years was consulting engineer for the New York Central, and a recognized authority on the subject of steel rails. Professor Boardman, who is a graduate of the Sheffield Scientific School, Yale University, has a long record of broad, practical experience in the railway engineering field. He commenced railway service in 1889 with the Pennsylvania as an instrumentman on branch line surveys, and was advanced through the engineering department to the position of senior assistant engineer on the North River tunnels. In 1909, he went with the Missouri Pacific, serving as senior assistant engineer and division engneer until 1912, when he went to South America as chief assistant engineer of the Buenos Aires Western Railway. In 1916, Professor Boardman became assistant to the general valuation counsel for the New York Central. From 1922 to 1929, he was connected with a number of industrial concerns, going with the Boston & Maine on the latter date as construction engineer.

U. P. Employees Organize to Fight Unfair Competition

The Union Pacific is another road on which the employees are joining in an organized effort to recover traffic that has been lost to highway and other unregulated forms of transportation. To accomplish this, an employees organization has been established, which, in addition to the efforts of the individuals, is co-operating in securing the assistance of merchants and newspapers. One of the practices of the employee group is to utilize newspaper advertising in the furtherance of its cause. The advertisements are designed to acquaint the public with the number of railway employees in the community served by the paper as well as with the amount of their compensation, in addition to other facts pertaining to the relation between the welfare of the railways and that of the communities they serve.

I. C. C. Uses Unusual Method to Collect Recapture Funds

In the case of the Richmond, Fredericksburg & Potomac, the Interstate Commerce Commission has adopted an unusual method of collecting excess net railway operating income. At the suggestion and request of the commission, the Comptroller General of the United States, J. R. McCarl, has notified the R. F. & P. that all earnings of that road due from the government for the transportation of mail, passengers and freight will be withheld from the road until an amount equal to the indebtedness of the road to the government has accumulated, or until other satisfactory arrangements are made to pay off the indebtedness. The amount referred to is the sum of $696,705, which represents the unpaid portion of the excess income of the company for the years 1922-23, found by the commission to be payable to its recapture fund. In an order dated April 7, the commission directed the carrier to pay the amount within 90 days from that date. This the road failed to do.

ASSOCIATION NEWS

Roadmasters and Maintenance of Way Association

At a special meeting of the Executive Committee in Chicago, on Thursday, August 20, consideration was given to a letter received from the railway executives urging that the various railway associations curtail or suspend their conventions for the present. As an indication of their desire to co-operate with the railway managements in the crisis through which the railways are now passing, the Executive Committee voted (1) to postpone the convention until September 20-22, 1932, (2) to hold over the committee reports, all of which have been completed, for presentation at the next meeting, and in the meantime to ask the committees to continue working upon their reports in order that they may be as complete and up to date as possible at the time of presentation and, (3) to create two new committees to investigate new subjects that will be assigned to them. Because of the postponement of the convention, it was further voted that the dues of all members in good standing at the end of the present year be remitted for the calendar year 1932. In postponing the convention, the association will break a record of 48 years of consecutive annual meetings.

The Track Supply Association will also abandon its exhibit.

American Railway Engineering Association

In recognition of conditions in the railway industry, committees have been requested to confine their meetings to New York or Chicago or points intermediate between these cities. The committees have displayed their customary activity during the last month. The Committee on Yards and Terminals met at Niagara Falls, Ont., on July 29 with 11 members present; the Committee on Water Service convened at Chicago on August 11 with 18 present; the Committee on Economics of Railway Operation met at Toronto on August 13-14, with 14 present; and the Committee on Rules and Organization held a meeting in Chicago

Members of the Metropolitan Track Supervisors' Club at their Annual Summer Outing

on August 21 with 8 present. In addition, the Special Committee on Waterproofing Railway Structures met at Cleveland on August 20.

Among the committees which have called meetings for September are those on Rivers and Harbors at Washington on September 2, on Masonry at Montreal on September 17-18, on Track at Chicago on September 24 and on Grade Crossings in the same city on the following day. In addition the chairmen of subcommittees of the Roadway committee will meet in Chicago on September 19.

The special committee on Stresses in Track is proceeding actively with its investigation of the action of rail joints under locomotives, including recent studies, in cooperation with the Westinghouse Electric & Manufacturing Company, on the action of rail joints under electric locomotives on the Great Northern. The Committee is also making extended investigations in the laboratories of the University of Illinois on various designs of rail joints.

Work is also getting under way on the investigation of transverse fissures at the laboratory of the University of Illinois, conducted under the joint direction of the A. R. E. A. and the rail manufacturers.

Bridge and Building Association

At a meeting held in Chicago on Saturday, August 29, the action taken at a meeting on July 25 transferring the convention scheduled to be held in Toronto, Ont., on October 20-22 to Chicago and curtailing it to two days, was reconsidered and it was decided to postpone the convention for one year. This action was taken in response to a resolution from the railway executives urging that this step be taken in view of the stringency of the situation through which the railways are now passing and the advisability of curtailing all demands on railway officers other than on their own properties.

Following the meeting on July 25 the officers of the Bridge and Building Supply Men's Association voted to eliminate their exhibit this year.

International Track Supervisors' Club

The International Track Supervisors' Club met on August 17 at the General Brock Hotel, Niagara Falls, Ontario. At this meeting it was decided to change the name of the club to the International Railway Maintenance Club, thereby broadening the scope of the club to include men in the engineering, bridge, building and signal departments. The next meeting will be held on Thursday, November 12, at Buffalo, N. Y.

Sling Chains.—The American Chain Company, Inc., Bridgeport, Conn., has issued a booklet giving information on all standard types of sling chains. Some of the most interesting information contained in the booklet includes specifications, definitions, instructions governing the purchase and use of chain, and a chart which shows the safe working loads of iron sling chains when used at various angles.

PERSONAL MENTION

Engineering

C. S. Tingley has been appointed chief engineer of the Sand Springs Railway, with headquarters at Sand Springs, Okla.

William M. Stokes, resident engineer of the Esquimalt & Nanaimo, has been promoted to engineer, with headquarters as before at Victoria, B. C., to succeed **Robert A. Bainbridge,** who has retired.

The position of engineer maintenance of way of the Oregon Short Line, which has been held by **L. W. Althof,** with headquarters at Pocatello, Idaho, has been abolished and the duties of the position assumed by **B. H. Prater,** chief engineer at Salt Lake City, Utah.

C. J. Frederici, division engineer on the Chicago & North Western, at South Pekin, Ill., has been assigned to other duties and his position abolished. **E. L. Mead,** division engineer at Chicago, has had his territory extended to include that formerly under the jurisdiction of the South Pekin office.

J. B. Akers, assistant to the operating vice-president of the Southern, in charge of maintenance of way, has been appointed assistant chief engineer, with supervision over maintenance of way and such other duties as may be assigned to him, with headquarters as before at Washington, D. C. **O. D. Colaw,** engineer maintenance of way, with headquarters at Macon, Ga., has been transferred to Chattanooga, Tenn., succeeding **R. Hayes,** who has been appointed assistant engineer of bridges, Lines West, with headquarters at Cincinnati, Ohio. The position of engineer maintenance of way at Macon has been abolished and the territory placed under the jurisdiction of the Chattanooga office.

Rudolf P. Forsberg, principal assistant engineer of the Pittsburgh & Lake Erie, has been promoted to chief engineer, with headquarters as before at Pittsburgh, Pa., to succeed **A. R. Raymer,** assistant vice-president and chief engineer, who was recently relieved of the duties of chief engineer and whose death is noted elsewhere in these columns. **George H. Burnette,** chief engineer of the Monongahela, with headquarters at Brownsville, Pa., has been appointed assistant chief engineer of the P. & L. E., at Pittsburgh. **Fred J. Nannah,** engineer of construction and valuation engineer of the P. & L. E., has been appointed engineer maintenance of way at Pittsburgh, succeeding **E. W. Boots.**

Mr. Forsberg was born at Lynchburg, Va., in November, 1870. He entered railroad work in June, 1887, as a rodman on the Lynchburg & Durham (now part of the Norfolk & Western). In 1888, he went with the Richmond & Danville (now part of the Southern) as rodman, being promoted to levelman and transitman in 1889. During the construction of the Yadkin division of that road in 1890 and 1891, he was resident engineer, with office at Salisbury, N. C. He left the employ of this road in 1891, to become a draftsman in the office of an architect at Richmond, Va., but returned to railway service the following year as draftsman in the office of the engineer of maintenance of way of the Norfolk &

Rudolf P. Forsberg

Western, at Roanoke, Va. In September, 1892, he left that company to go with the New York Central Lines as a draftsman in the office of the engineer maintenance of way of the Pittsburgh & Lake Erie, at Pittsburgh, Pa., later being transferred to the office of the chief engineer in the same capacity. In March, 1899, he was appointed chief draftsman at Pittsburgh, and in 1902 he was appointed assistant engineer at the same place, being promoted to special engineer in July, 1919. On March 1, 1920, he was made principal assistant engineer, with office at Pittsburgh, which position he held until his recent promotion.

Following the consolidation of a number of divisions as well as other changes on the Louisville & Nashville, a number of roadmasters have been appointed to the newly created position of division engineer. **W. S. Moore,** roadmaster on the Owensboro division with headquarters at Owensboro, Ky., has been appointed division engineer of the combined Louisville, Cincinnati & Lexington and Louisville divisions, under the name of the Louisville division, with headquarters at Louisville, Ky. The greater part of the Owensboro division has been consolidated with the St. Louis & Henderson division, under the name of the Evansville division, and **L. L. Adams,** roadmaster of the Louisville terminals, at Louisville, has been appointed division engineer of the new Evansville division and of the East St. Louis terminals, with headquarters at Evansville, Ind. **J. C. Nickerson,** roadmaster of the Cincinnati and Cincinnati Terminals divisions, has been appointed division engineer of these divisions with headquarters as before at Latonia, Ky. Prior to September 1, the Cincinnati division was known as the Kentucky division. The following roadmasters have been appointed division engineers of their respective divisions with

headquarters at the same points: **A. F. Frendberg,** Eastern Kentucky division, at Ravenna, Ky.; **J. S. Hestle,** Nashville division and Nashville terminals, at Nashville, Tenn.; and **G. C. Wendling,** Memphis Line, Nashville. **R. N. Crapster,** roadmaster at Paris, Ky., has been appointed division engineer of the Birmingham division with headquarters at Birmingham, Ala. **R. S. Goldthwaite,** roadmaster of the Mobile & Montgomery division, with headquarters at Montgomery, Ala., has been appointed division engineer of the combined Mobile & Montgomery and New Orleans & Mobile divisions, under the name of the Montgomery & New Orleans divisions.

P. J. McCarthy, acting division engineer of the Southern division of the Kansas City Southern and acting chief engineer of the Texarkana & Ft. Smith, with headquarters at Texarkana, Tex., has been appointed permanently to these positions. Mr. McCarthy was born on July 13, 1879, at Wilbur, Neb., and was educated at the University of Kansas. He entered the service of the K. C. S. in May, 1914, as a transitman on valuation, later becoming an assistant engineer on the same work. Following the completion of the valuation work, Mr. McCarthy became a draftsman at Kansas

P. J. McCarthy

City, Mo., later being again appointed assistant engineer. After a time in this position, he was appointed roadmaster at Shreveport, La., following which he became assistant engineer on construction and bank protection work. He was holding the latter position at the time of his appointment as acting division engineer of the Southern division and acting chief engineer of the Texarkana & Ft. Smith, which became effective early this year.

W. W. Benny, division engineer of the Ottawa division of the Canadian Pacific, with headquarters at Ottawa, Ont., has been appointed to the same position on the combined Ottawa and Smith's Falls division, known as the Smith's Falls division, with headquarters at Smith's Falls, Ont. **J. R. Caswell,** division engineer of the former Smith's Falls division, at Smith's Falls, has been transferred to the Montreal terminals, at Montreal, Que., where he succeeds **J. A. MacKenzie,** whose appointment as roadmaster is noted elsewhere in these columns. **L. S. Rudder,** division engineer of the Bruce division, with headquarters at Toronto, Ont., has been appointed assistant division engineer of the Trenton division, with the same headquarters, following the consolidation of the Bruce and the Toronto Terminals divisions. **V. A. G. Dey,** division engineer of the Toronto Terminals division, with headquarters at Toronto, has had his jurisdiction extended to include the Bruce division. **J. F. Earl,** assistant superintendent at Ignace, Ont., has been appointed division engineer of the Portage division, with headquarters at Winnipeg, Man.

Track

C. H. Shrier, general track inspector of the Eastern district of the Eastern lines of the Atchison, Topeka & Santa Fe, has had his jurisdiction extended to include the Western district of these lines, with headquarters as before at Topeka, Kan.

Pat Herd, roadmaster on the St. Louis-San Francisco, with headquarters at Carl Jct., Mo., has retired after 54 years of service with this road and the position of roadmaster at Carl Jct. has been abolished. **C. E. Armstrong,** roadmaster at Wichita, Kan., has been transferred to Neodesha, Kan.

C. B. Brown, assistant supervisor of track on the Ft. Wayne division of the Pennsylvania, has been promoted to supervisor of track on the Grand Rapids division, with headquarters at Petoskey, Mich., succeeding **H. D. Van Vranken,** who has been transferred to the Toledo division, with headquarters at Toledo, Ohio, to succeed **W. H. Thompson.**

J. A. MacKenzie, division engineer of the Montreal Terminals division of the Canadian Pacific, with headquarters at Montreal, Que., has been appointed roadmaster at Lindsay, Ont., succeeding **F. W. Nicholls,** who has retired. Following the consolidation of the Souris and Brandon divisions of this road into one division, **G. W. Coburn,** division engineer of the former division, with headquarters at Souris, Man., has been appointed roadmaster at Brandon, Man., where he succeeds **C. H. Johnson,** who has been transferred to Minnedosa, Man., succeeding **G. York,** transferred. **M. J. Sullivan,** roadmaster at Portage la Prairie, Man., has retired.

N. H. Self, roadmaster of the Northern Alabama (unit of the Southern), with headquarters at Sheffield, Ala., has been transferred to the Mobile division of the Southern, with headquarters at Selma, Ala., where he succeeds **J. S. Moore.** Mr. Moore has been transferred to the Birmingham division, with headquarters at Birmingham, Ala., succeeding **J. H. Waters,** who has been appointed supervisor of track on the Northern Alabama, at Sheffield. Mr. Moore also has jurisdiction over the Northern Alabama, the position of roadmaster of this line having been abolished. **Pelham Blackford** has been appointed assistant supervisor of the Birmingham division, with headquarters at Birmingham.

Bridge and Building

H. W. Bryant, assistant supervisor of bridges and buildings on the Missouri Pacific, at Coffeyville, Kan., has been promoted to supervisor of bridges and buildings at the same point to succeed **H. Wrights,** who has been transferred to Falls City, Neb.

J. H. Johnson, superintendent of bridges and buildings of the Southern Ontario district of the Canadian National, with headquarters at Toronto, Ont., has retired after 45 years of service with this road. The position of superintendent of bridges and buildings at Toronto has been abolished.

D. C. Barrett, division engineer of the Minnesota division of the Chicago & North Western, with headquarters at Winona, Minn., has been appointed supervisor of bridges and buildings at the same point, succeeding **J. W. McCarl,** following the merging of the Minnesota division with the Madison and Dakota divisions.

J. H. Hartwell, supervisor of bridges and buildings, with headquarters at Rapid City, S. D., has moved his headquarters to Pierre, S. D.

Following the consolidation of the Bruce and Toronto Terminals divisions of the Canadian Pacific into one division, **H. Harrison,** bridge and building master of the latter division, with headquarters at Toronto, Ont., has had his jurisdiction extended to include the former Bruce division. **M. J. Trudeau,** bridge and building master of the Bruce division, has been transferred to the Trenton division, with headquarters as before at Toronto, succeeding **A. C. Price,** who has been assigned to other duties. **R. V. Nicholson,** bridge and building master of the Ottawa division, with headquarters at Ottawa, Ont., has retired after 47 years of service with this road.

Obituary

W. A. Simpson, roadmaster on the Chicago, Rock Island & Pacific, with headquarters at Topeka, Kan., died on August 7, at his home in that city.

John Treutner, roadmaster on the Atchison, Topeka & Santa Fe, with headquarters at Albuquerque, N. M., was found dead near Domingo, N. M., on August 13.

Martin J. Caples, a railway engineer of long experience in location, construction and maintenance and who retired in 1928 as vice-president of the Seaboard Air Line, died on July 29, at Trenton, N. J., at the age of 67 years. Mr. Caples first entered railway service in 1883, as a rodman on the Boston & Lowell and served in various capacities in the engineering department of this road until 1887, when

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143

GEO TRACK CONSTRUCTION

he went to South America to engage in hydraulic mining and railroad surveys. A year later Mr. Caples returned to this country and served until August, 1899, as resident engineer, track supervisor and engineer in charge of maintenance of way on the Norfolk & Western. After engaging in private business for a year, he served as engineer maintenance of Columbus, Sandusky & Hocking, until April, 1902. From this date until September, 1905, he served successively as treasurer, superintendent and general manager of the Pocahontas Coal & Coke Co., a subsidiary of the Norfolk & Western. On the latter date Mr. Caples went with the South & Western as general manager and chief engineer, in which position he also served this road's successor, the Carolina, Clinchfield & Ohio, later becoming vice-president and general manager. On November 1, 1911, he became vice-president of the Chesapeake & Ohio and the Hocking Valley, with which roads he served until August, 1918, when he went with the Seaboard Air Line as vice-president, which position Mr. Caples retained until his retirement in 1928.

A. R. Raymer, assistant vice-president (operating) of the Pittsburgh & Lake Erie, with headquarters at Pittsburgh, Pa., died at his home in Beaver, Pa., on August 10, following a long illness. Mr. Raymer was born on December 1, 1862, in Canada, and was educated at Toronto University, Toronto, Canada. He entered railway service in 1884, on a road that is now part of the Canadian National and was on location and construction from Gravenhurst to North Bay, Ont.

A. R. Raymer

From 1886 to 1889, he was on location and construction with the International Railway of Maine (now a part of the Canadian Pacific). During 1889, he was on location on a part of the Canadian National from Waterloo to Elmira, Ont., and from 1889 to 1891, he worked for the Louisville & Nashville on the construction of the Cumberland Valley extension from Cumberland Gap to Big Stone Gap. Mr. Raymer was with the Lake Shore & Michigan Southern (now part of the New York Central) from 1891 to 1896 at Toledo, Ohio, as assistant engineer on maintenance in charge of office and field surveys. In 1896 he entered the service of the Pittsburgh & Lake Erie as assistant chief engineer, which position he held until March, 1920, when he was appointed chief engineer. In July, 1926, he was appointed assistant vice-president in addition to chief engineer, which positions he held until a short time before his death when he was relieved of the duties of chief engineer.

Edwin H. McHenry, formerly chief engineer of the Northern Pacific, chief engineer of the Canadian Pacific and vice-president of the New York, New Haven & Hartford, died on August 22, at his home in Ardmore, Pa., a suburb of Philadelphia.

S. T. Wagner, consulting engineer of the Reading, died suddenly at his home in Philadelphia, Pa., on August 7. Mr. Wagner was born on August 30, 1861, at Philadelphia, and was graduated from the University of Pennsylvania in 1881. From 1881 until 1893, he was with the Phoenix Iron Company, starting as a draftsman, then becoming inspector, assistant master mechanic and finally superintendent of shops. From 1894 until 1900, Mr. Wagner was assistant engineer in charge of the Pennsylvania avenue subway and tunnel, and from the latter date until 1902, was assistant engineer in charge of improvement and filtrations of water supply, being appointed to both divisions by the Bureau of Surveys of Philadelphia. He entered the service of the Philadelphia & Reading (now the Reading) on March 1, 1902, and from that time until 1915, was in charge of the abolishment of grade crossings of that company. On April 6, 1915, he was appointed chief engineer, which position he held until January, 1927, when he retired from active duty, and became consulting engineer of the Reading, in which capacity he served until his death.

S. T. Wagner

Voids Texas Trucking Law

A law prohibiting motor trucks from hauling more than 10 bales of uncompressed cotton or 20 bales of compressed cotton and requiring that the bales must be transported in closed vans, which was recently enacted by the Texas legislature, has been declared unconstitutional by a federal court at Houston.

SUPPLY TRADE NEWS

E. D. Jackson, general manager of the Syntron Company, Pittsburgh, Pa., died at Baltimore, Md., on August 17, following a major operation.

R. E. Walker, representative of the **American Rolling Mill Company,** with headquarters at Middletown, Ohio, has been placed in charge of the office at Tulsa, Okla.

L. S. Hamaker, advertising manager of the **Republic Steel Corporation,** has been appointed manager of sales promotion, with headquarters at Youngstown, Ohio.

Otis B. Duncan has been appointed railroad representative in the Chicago territory for the **Northwestern Manufacturing Company,** Milwaukee, Wis., makers of Hansen electric arc welders.

The Illinois Malleable Iron Company, Chicago, has taken over the manufacture and sale of the Ericson rail anchor, formerly manufactured by the Verona Tool Works, and has appointed the **Industrial & Railroad Supply Company,** 310 South Michigan avenue, Chicago, representatives in charge of sales.

The A. M. Byers Company, Pittsburgh, Pa., has taken a six-months option to purchase the **Canonsburg Steel & Iron Works,** Canonsburg, Pa. The latter company which is controlled by the Edwards Manufacturing Company, Cincinnati, Ohio, was founded in 1902 and has an annual capacity of 38,000 tons of black sheets and 16,000 tons of galvanized sheets.

The Robert W. Hunt Company, Chicago, has installed an X-ray laboratory service for the inspection and testing of metallic materials. These facilities are designed to X-ray steel objects up to 3½ in. in thickness and aluminum objects up to 8 in. in thickness, while there is no limit to the size of the specimens that may be tested providing they can be loaded on a freight car.

Alva Clymer Dinkey, president of the Midvale Company and formerly president of the Carnegie Steel Company, died on August 11 of heart disease at his home in Wynnewood, Pa., after an illness of three months. Mr. Dinkey, who was 65 years of age, commenced his career in the steel business in 1879 at the Edgar Thomson Steel Works as a water boy. He was advanced through various positions at these works and in 1885 he went with the Pittsburgh Locomotive Works, Allegheny, Pa., later going with the McTighe Electric Company, Pittsburgh, Pa. Mr. Dinkey then went with the Carnegie Steel Company and was elected president in 1903, resigning in 1915 to become president of the Midvale Steel & Ordnance Co. He was elected president of the Midvale Company in 1923.

It saves you

men, minutes and money!

12 — In railway stores departments, loading, unloading, stacking and distributing materials.

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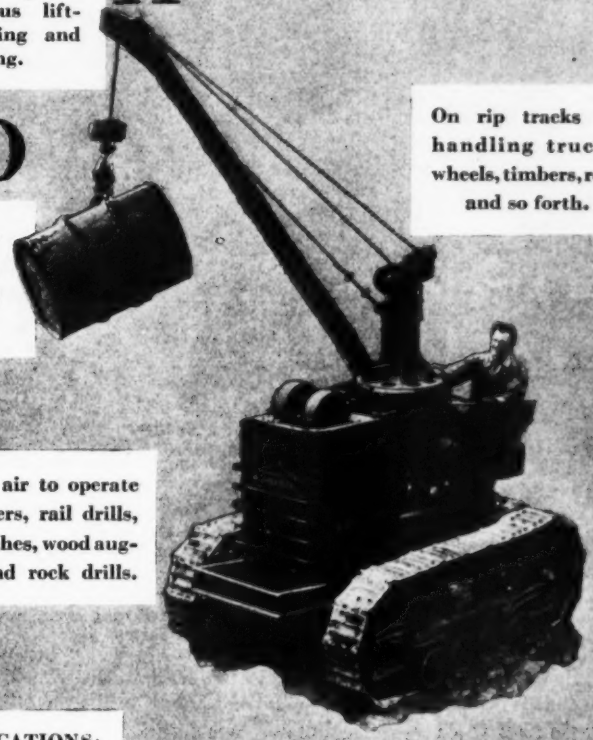
11 — In locomotive and car repair shops for miscellaneous lifting, handling and hauling.

1 — In railroad roundhouses for handling locomotive driving rods, pistons, pumps, car wheels, etc.

10 — For loading, unloading, and laying ties, also for handling during treatment.

On rip tracks for handling trucks, wheels, timbers, rods and so forth.

2 — Lifting, handling and carrying freight at freight stations and transfer points.



9 — With air to operate tampers, rail drills, wrenches, wood augers and rock drills.

3 — Handling and laying rails, crossovers, frogs, placing track signals, switches.

8 — SPECIFICATIONS: Rated 3,500 pounds capacity full-revolving boom; wheel or crawler mounting.

4 — OPTIONAL EQUIPMENT: Air compressor, electro-magnet, 12,500-pound winch, bull-dozer.

7 — Service and repair work around city terminals — pavement breaking with air hammers.

5

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LOADMASTER

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Baldwin-Southwark Corp.
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Air Lift Pumping Machinery
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Anti-Creepers, Rail
American Fork & Hoe Co.
Bethlehem Steel Co.
Lundie Engineering Co.
P. & M. Co.
Verona Tool Works
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Backfillers
Buckeye Traction Ditcher Co.

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Ballast Screens
Maintenance Equipment Co.

Ballast Spreaders
Bucyrus-Erie Co.
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Ballaster, Power
Maintenance Equipment Co.

Bank Builders
Bucyrus-Erie Co.

Bank Slopers
Bucyrus-Erie Co.

Band Saws
American Saw Mill Machinery Co.

Bars
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company

Bearings, Axle
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.

Bearings, Roller
Timken Roller Bearing Co.

Bearings, Tapered Roller; Thrust and Journal Box
Timken Roller Bearing Co.

Benders, Rail
See Rail Benders

Blocks, Creosoted
So. Wood Preserving Co.

Bolts
Bethlehem Steel Co.
Illinois Steel Co.
Louisville Frog, Switch & Signal Co.
Oliver Iron & Steel Corp.

Bonding Outfits, Rail
Ingersoll-Rand Co.
Syntron Co.

Braces, Track
Louisville Frog, Switch & Signal Co.
Ramapo Ajax Corp.

Bridge Floors
Illinois Steel Co.

Bridge Warnings
Hastings Signal & Equipment Co.

Buckets
Bucyrus-Erie Co.

Building Beams, Concrete
Federal-American Cement Tile Co.
Massey Concrete Products Corp.

Buildings, Steel Frame
Butler Mfg. Co.

Bumping Posts
Louisville Frog, Switch & Signal Co.
Mechanical Mfg. Co.

Car Replacers
Louisville Frog, Switch & Signal Co.

Car Stop, Friction
Maintenance Equipment Co.

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Oxweld Railroad Service Co.

Carbide
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Cars, Hand
Fairbanks, Morse & Co.
Fairmont Ry. Motors, Inc.

Cars, Industrial
Bethlehem Steel Co.
Koppel Industrial Car & Equipment Co.
Magor Car Corp.
Western Wheeled Scraper Co.

Cars, Inspection
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.

Cars, Motor
Fairbanks, Morse & Co.
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Cars, Section
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.

Cars, Spreader
Bucyrus-Erie Co.
Western Wheeled Scraper Co.

Cars, Velocipede
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.

Castings
Bethlehem Steel Co.
Timken Roller Bearing Co.
Wharton, Jr. & Co., Inc., Wm.

Caterpillar Tractors
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Fairbanks, Morse & Co.

Cattle Passes
Massey Concrete Products Corp.

Cement Roofing Tile
Federal-American Cement Tile Co.

Chemical Weed Killer
Chipman Chemical Engineering Co., Inc.

Clay Diggers
Buckeye Traction Ditcher Co.

Clips, Adjustable
Louisville Frog, Switch & Signal Co.
Ramapo Ajax Corp.

Coal Handling Machinery
Buckeye Traction Ditcher Co.
Northwest Engineering Co.

Coaling Stations
Fairbanks, Morse & Co.

Compressors
Ingersoll-Rand Co.

Compromise Joints
See Joints, Compromise

Concrete Roofing Tile
Federal-American Cement Tile Co.

Concrete Units, Miscellaneous
Federal-American Cement Tile Co.
Massey Concrete Products Corp.

Condensers
Ingersoll-Rand Co.

Corrosion Preventive
Dearborn Chemical Co.

Cranes
Buckeye Traction Ditcher Co.
Bucyrus-Erie Co.
Northwest Engineering Co.
Orton Crane & Shovel Co.

Cribbing, Concrete
Federal-American Cement Tile Co.
Massey Concrete Products Corp.

Crossings, Rail
Bethlehem Steel Co.
Louisville Frog, Switch & Signal Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Culvert Pipe
Gohi Culvert Mfrs., Inc.
Massey Concrete Products Corp.

Culverts, Corrugated Metal
Gohi Culvert Mfrs., Inc.

Culverts, Treated
So. Wood Preserving Co.

Curbing
Massey Concrete Products Corp.

Derails
Q. & C. Co.
Wharton, Jr. & Co., Wm.

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Fairmont Railway Motors, Inc.

Disinfectants
Chipman Chemical Engineering Co., Inc.

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Buckeye Traction Ditcher Co.

Ditchers, Drainage
Buckeye Traction Ditcher Co.
Bucyrus-Erie Co.
Northwest Engineering Co.

Ditchers, Open
Buckeye Traction Ditcher Co.

Ditchers, Tile
Buckeye Traction Ditcher Co.
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Draglines
Buckeye Traction Ditcher Co.
Northwest Engineering Co.

Drills, Portable Electric
Syntron Co.

Drills, Pneumatic
Ingersoll-Rand Co.

Drills, Rock
Ingersoll-Rand Co.
Verona Tool Works

Drill Steel, Rock
Bethlehem Steel Co.
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Buckeye Traction Ditcher Co.
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American Steel & Wire Co.
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Rail Joint Co.
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The chemical spray penetrates those "hard to get at" places which are impossible to reach with hand tools.

This method costs only from 3 to 5 dollars per mile to kill all the weeds on the right of way outside the ballast area as listed below.

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CLASSIFIED INDEX TO ADVERTISERS—(Continued)

Manganese Track Work
Bethlehem Steel Co.
Louisville Frog, Switch & Signal Co.
Ramapo Ajax Corp.
Wharton, Jr. & Co., Wm.

Manholes
Massey Concrete Products Corp.

Markers
Massey Concrete Products Corp.

Mile Posts
Massey Concrete Products Corp.

Motor Bearings
Timken Roller Bearing Co.

Motors and Generators
Fairbanks, Morse & Co.

Mowing Machines
Fairmont Railway Motors, Inc.

Non-Derailer
Ramapo Ajax Corp.

Nut Locks
Bethlehem Steel Co.
Louisville Frog, Switch & Signal Co.
National Lock Washer Co.
Reliance Manufacturing Co.
Verona Tool Works.
Woodings Forge & Tool Co.

Nuts
Bethlehem Steel Co.
Illinois Steel Co.
Louisville Frog, Switch & Signal Co.

Out Houses
Massey Concrete Products Corp.

Oxy - Acetylene Welding Equipment
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Oxygen
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National Lead Co.
U. S. Graphite Co.

Paint, Graphite
U. S. Graphite Co.

Paint, Metal Protecting
National Lead Co.
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Penstocks
Fairbanks, Morse & Co.

Pile Drivers
Bucyrus-Erie Co.
Ingersoll-Rand Co.

Piling
Bethlehem Steel Co.
Carnegie Steel Co.
Massey Concrete Products Corp.
Southern Wood Preserving Co.

Pipe Carriers
Massey Concrete Products Corp.

Pipe, Concrete
Massey Concrete Products Co.

Pipe, Corrugated
Gohl Culvert Mfrs., Inc.

Pipe, Sewer
Massey Concrete Products Corp.

Plates, Miscellaneous
Louisville Frog, Switch & Signal Co.
Ramapo Ajax Corp.

Plows
Western Wheeled Scraper Co.

Poles
Jackson Lumber Co.
Massey Concrete Products Corp.
Southern Wood Preserving Co.

Poles, Treated
So. Wood Preserving Co.

Power Jack
Baldwin-Southwark Corp.
Southwark Foundry & Machine Co., Div.
Nordberg Mfg. Co.

Power Plants, Portable
Syntron Co.

Preservation, Timber
Curtin-Howe Corp.
Southern Wood Preserving Co.

Pumps
American Well Works.
Fairbanks, Morse & Co.
Ingersoll-Rand Co.
Layne & Bowler, Inc.

Push Cars
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.

Push Car Bearings
Timken Roller Bearing Co.

Rail Anchors
American Fork & Hoe Co.
Bethlehem Steel Co.
Louisville Frog, Switch & Signal Co.
Lundie Engineering Corp.
P. & M. Co.
Verona Tool Works
Woodings Forge & Tool Co.

Rail Benders
Q. & C. Co.
Louisville Frog, Switch & Signal Co.
Q. & C. Co.
Verona Tool Works.

Rail Bonds
American Steel & Wire Co.
Verona Tool Works.

Rail Braces
Bethlehem Steel Co.
Louisville Frog, Switch & Signal Co.
Q. & C. Co.
Ramapo Ajax Co.
Wharton, Jr. & Co., Wm.

Rail Expanders
Ramapo Ajax Corp.

Rail Layers
Buckeye Traction Ditcher Co.
Maintenance Equipment Co.
Nordberg Mfg. Co.

Rail Saws, Portable
Syntron Co.

Rail Shims
American Fork & Hoe Co.

Rail Springs
Verona Tool Works.

Rails, Girder
Bethlehem Steel Co.

Rails, Tee
Bethlehem Steel Co.
Carnegie Steel Co.
Louisville Frog, Switch & Signal Co.

Reconditioning, Rail Crossing & Frogs
Morrison Railway Supply Corp.
Syntron Co.

Retaining Walls, Precast
Federal-American Cement Tile Co.
Massey Concrete Products Corp.

Rivets
Bethlehem Steel Co.
Louisville Frog, Switch & Signal Co.

Rock Hammers
Ingersoll-Rand Company

Rods, Welding
Oxweld Railroad Service Co.
Syntron Co.

Roof Slabs
Federal-American Cement Tile Co.
Massey Concrete Products Corp.

Roofing, Cement & Concrete Tile
Federal-American Cement Tile Co.

Rules
Lufkin Rule Co.

Rust Preventive
Dearborn Chemical Co.

Safety Flags
Louisville Frog, Switch & Signal Co.

Saw Rigs
American Saw Mill Machinery Co.
Fairbanks, Morse & Co.

Saws, Electric
Reed-Prentice Corp.
Syntron Co.

Saws, High Speed Friction
American Saw Mill Machinery Co.

Saw Mills
American Saw Mill Machinery Co.

Saws, Portable, Rail
Q. & C. Co.
Syntron Co.

Saws, Timber
Reed-Prentice Corp.
Syntron Co.

Scales, Tape
Lufkin Rule Co.

Scales, Track
Fairbanks, Morse & Co.

Screw Spikes
Bethlehem Steel Co.
Illinois Steel Company.

Screw Spike Drivers
Ingersoll-Rand Co.
Nordberg Mfg. Co.
Syntron Co.

Sharpeners, Rock Drill Steel
Ingersoll-Rand Co.

Shovels
Verona Tool Works.
Woodings Forge & Tool Co.

Shovels, Gasoline Revolving
Buckeye Traction Ditcher Co.

Signals, Bridge & Warning
Hastings Signal & Equipment Co.

Skid Excavators & Dredges
Northwest Engineering Co.

Skid Shoes
Q. & C. Co.

Slabs, Concrete
Massey Concrete Products Corp.

Smokestacks
Massey Concrete Products Corp.

Snow Melting Device
Bethlehem Steel Co.
Louisville Frog, Switch & Signal Co.
Lundie Engineering Corp.
Ruby Railway Equipment Co.

Snow Plows
Q. & C. Co.

Spike Pullers
Louisville Frog, Switch & Signal Co.

Spikes
Bethlehem Steel Co.
Illinois Steel Co.

Standpipes
Fairbanks, Morse & Co.

Stands, Switch & Target
Bethlehem Steel Co.
Ramapo Ajax Corp.
Q. & C. Co.

Steam Shovels
Bucyrus-Erie Co.
Northwest Engineering Co.
Orton Crane & Shovel Co.

Steel, Alloy
Bethlehem Steel Co.
Illinois Steel Company.

Steel, Electric Furnace
Bethlehem Steel Co.
Timken Roller Bearing Co.

Steel Frame Houses
Butler Mfg. Co.

Steel, Open Hearth
Bethlehem Steel Co.
Carnegie Steel Co.
Timken Roller Bearing Co.

Steel Plates and Shapes
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company.

Steel, Special Analysis
Bethlehem Steel Co.
Timken Roller Bearing Co.

Storage Tanks
Pittsburgh-Des Moines Steel Co.

Structural Steel
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company.

Switch Guard
Louisville Frog, Switch & Signal Co.
Ramapo Ajax Corp.

Switching Engine
Baldwin-Southwark Corp.
Southwark Foundry & Machine Co., Div.

Switchmen's Houses
Massey Concrete Products Corp.

Switches
Bethlehem Steel Co.
Louisville Frog, Switch & Signal Co.
Ramapo Ajax Corp.
Wharton, Jr. & Co., Wm.

Switchpoint Protectors
Maintenance Equipment Co.

Switchstands & Fixtures
Bethlehem Steel Co.
Louisville Frog, Switch & Signal Co.
Ramapo Ajax Corp.
Wharton, Jr. & Co., Wm.

Tampers, Tie
See Tie Tampers.

Tanks & Fixtures
Fairbanks, Morse & Co.

Tanks, Steel
Pittsburgh-Des Moines Steel Co.

Tapes, Measuring
Lufkin Rule Co.

Telltales
Hastings Signal & Equipment Co.

Thawing Outfits
Lundie Engineering Corp.
Q. & C. Co.
Ruby Railway Equipment Co.

Tie Boring Machine
Syntron Co.

Tie Plate Clamps
Q. & C. Co.

Tie Plates
Bethlehem Steel Co.
Illinois Steel Co.
Louisville Frog, Switch & Signal Co.
Lundie Engineering Corp.

Tie Rods
Bethlehem Steel Co.
Louisville Frog, Switch & Signal Co.

Tie Spacers
Maintenance Equipment Co.

Tie Tampers
Ingersoll-Rand Co.
Syntron Co.

Ties, Steel
Bethlehem Steel Co.
Carnegie Steel Co.

Ties, Treated
Curtin-Howe Corp.
Southern Wood Preserving Co.

Tile, Roofing
Federal-American Cement Tile Co.

Timber, Treated
Southern Wood Preserving Co.

Tools, Electric
Syntron Co.

Tools, Pneumatic
Ingersoll-Rand Co.

Tools, Track
Maintenance Equipment Co.
Q. & C. Co.
Verona Tool Works.
Woodings Forge & Tool Co.

Tongue Switches
Bethlehem Steel Co.
Ramapo Ajax Corp.
Wharton, Jr. & Co., Wm.

Track Bolt Wrench
Syntron Co.

Track Cranes
Buckeye Traction Ditcher Co.
Nordberg Mfg. Co.

Track Gages
Louisville Frog, Switch & Signal Co.
Verona Tool Works

Track Insulation
Q. & C. Co.

Track, Portable
Western Wheeled Scraper Co.

Track Shifter
Baldwin-Southwark Corp.
Southwark Foundry & Machine Co., Div.
Nordberg Mfg. Co.

Track, Special Work
Louisville Frog, Switch & Signal Co.
Ramapo Ajax Corp.
Wharton, Jr. & Co., Wm.

Tractors
Caterpillar Tractor Co.

Trestle Slabs
Massey Concrete Products Corp.

Trench Excavators
Buckeye Traction Ditcher Co.

Trucks, Hand Steel
Anchor Post Fence Co.

Tubing, Seamless Steel
Timken Roller Bearing Co.

Tunnel Warnings
Hastings Signal & Equipment Co.

Ventilators
Q. & C. Co.

Warning Devices, Bridge & Tunnel
Hastings Signal & Equipment Co.

Water Columns
Fairbanks, Morse & Co.

Water Cranes
Fairbanks, Morse & Co.

Water Supply Contractors
Layne & Bowler, Inc.

Water Tanks
Pittsburgh-Des Moines Steel Co.

Water Treating Tanks
Pittsburgh-Des Moines Steel Co.

Weed Burner
Fairmont Railway Motors, Inc.

Weed Killer
Chipman Chemical Engineering Co., Inc.
Q. & C. Co.

Welding and Cutting Apparatus, Acetylene
Oxweld Railroad Service Co.

Welding, Electric
Electric Railroad Sales Corp.
Hallen Welding Service, Inc.
Syntron Co.

Welding Rods
American Steel & Wire Co.

Welding Supplies
Oxweld Railroad Service Co.
Syntron Co.

Welding Wire
American Steel & Wire Co.

Well Systems
Layne & Bowler, Inc.

Wheels, Hand & Motor Car
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.

Wheels, Wrought Steel
Bethlehem Steel Co.
Carnegie Steel Co.

Windshields
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.

Wire Fencing
American Steel & Wire Co.
Anchor Post Fence Co.
Bethlehem Steel Co.
Page Fence Association

Wire, Welding
Oxweld Railroad Service Co.

Wood Preservation
See Preservation, Timber

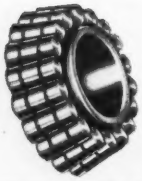
Wood Working Machinery
American Saw Mill Machinery Co.
Syntron Co.

Wrenches
Lowell Wrench Co.

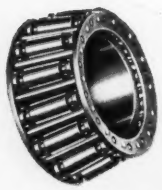
Zinc-Meta-Arsenite Treatment
Curtin-Howe Corp.

ALPHABETICAL INDEX TO ADVERTISERS

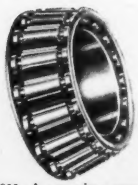
33 Years of Experience in making and applying Timken Bearings



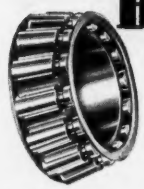
1898—The first Timken Bearing had no cage. This caused excessive friction due to contact of the rolls revolving against each other in opposite directions.



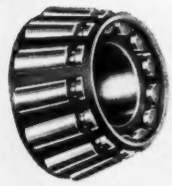
1898—Separation of the rollers by spacing them with small pilots integral with the rollers' heads.



1903—A one piece cage made from sheet steel by a series of press operations.



1909—A single nib on each roller reducing the width of the bearing and giving greater compactness without sacrificing capacity.



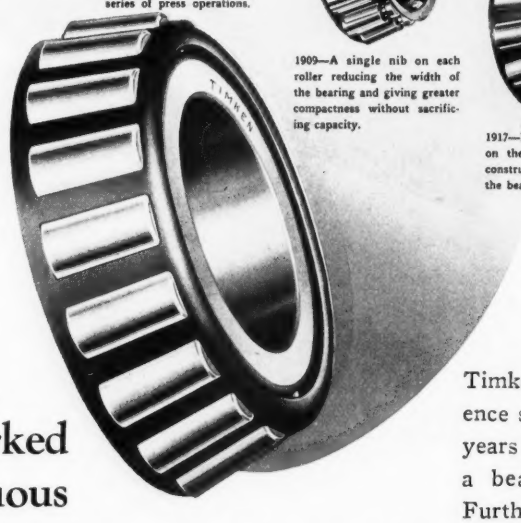
1917—Elimination of the wings on the cage, simplifying the construction and operation of the bearing.

1918—Elimination of both nibs from the roll ends still further increasing the compactness and capacity of the bearing.

The Timken Bearing of Today—Maximum Capacity with Minimum Friction.

Material: Timken-made steel.

Design: A full complement of rollers uniformly spaced around the cone by a truly perforated cage, thus uniformly distributing the load and eliminating internal friction. The rollers are also positively aligned longitudinally by two-area contact on the cone rib.



A third of a century marked by a continuous series of engineering accomplishments in taking friction and headaches out of one industry after another.

The successful application of an anti-friction bearing to any industry or to any type of equipment vitally requires two basic factors. *First,* correct bearing design, material and construction. *Second,* long experience in applying the bearing to meet individual specialized problems.

The first of these factors has been taken care of by one improvement after another over a period of 33 years.

The second factor—experience—is equally important, both to machinery makers and users. Timken's 33 years of experience show that it takes several years to thoroughly prove out a bearing in any industry. Furthermore, it takes many years to develop the proper refinements in a product for the specialized service of any given industry—such refinements as the correct heat treating, the necessary precision processes of manufacture, and the proper engineering of bearing mountings. These things come only from minute contact and serious study of the actual operation of the bearing in the field over a period of many years.

Timken Bearings have long since passed that period. The great body of Timken users know that when they buy a Timken-equipped machine they are not experimenting, but that they have the two factors necessary for satisfactory machine operation—the correct bearing, *and* Timken's long experience in applying, mounting, enclosing and engineering that bearing for specific applications.

THE TIMKEN ROLLER BEARING CO., CANTON, OHIO

TIMKEN *Tapered Roller* **BEARINGS**